DOCUMENT RESUME

ED 314 922 EC 222 082

AUTHOR Craney, Thomas J.
TITLE A Neuropsychological Consultation Model Designed To Foster Wholebrain and Cognitive Style-Responsive Instruction for "At Risk" Elementary School Students.
PUB DATE 89
NOTE 169p.; Ed.D. Practicum Report, Nova University.
PUB TYPE Dissertations/Theses - Practicum Papers (043) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC07 Plus Postage.
DESCRIPTORS Brain Hemisphere Functions; *Cognitive Style; Elementary Education; *High Risk Students; *Inservice Teacher Education; Learning Strategies; Models; *Neurological Organization; Staff Development; *Teaching Methods
IDENTIFIERS *Whole Brain Learning

ABSTRACT

The practicum was designed to establish a staff development program to help teachers to systematically employ whole-brain and responsive instructional approaches with "at risk" students and to provide the theoretical/conceptual, practical, and experiential knowledge base necessary for program development incorporating cognitive styles. The actual practicum audience was the full teaching staffs of 4 elementary schools, involving more than 70 educators. The practicum: (1) provided target individuals with training in basic neuroscience; (2) promoted an understanding of learning/cognitive styles within the instructional context of the classroom, through a styles self-analysis process; (3) helped teachers develop and employ lessons, instructional strategies, and materials that were responsive to "at risk" students; and (4) provided the knowledge base necessary for cognitive styles program development. The practicum included inservice programming for teachers and support staff, individual cognitive style/preference profiling, coaching, lesson plan development and teaching, and evaluation. Practicum evaluation indicated positive results. Seventeen appendices include support material, evaluation instruments and participant responses. (JDD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED314922

PRACTICUM REPORT

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Center for the
Advancement of Education
Ed.D. Program

A Neuropsychological Consultation Model Designed to Foster Wholebrain and Cognitive Style-Responsive Instruction for "At Risk" Elementary School Students

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Thomas J Cooney

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

3301 College Avenue
Fort Lauderdale, Florida 33314
305/475-7300

NOVA UNIVERSITY

EC222082

BEST COPY AVAILABLE

A Neuropsychological Consultation Model Designed to Foster Wholebrain and Cognitive Style-Responsive Instruction for "At Risk" Elementary School Students

by

Thomas J. Craney
Cluster XXI

A Practicum II Report Presented to the Ed.D. Program
in Early and Middle Childhood
in Partial fulfillment of the Requirements
for the Degree of Doctor of Education

NOVA UNIVERSITY

1989

PRACTICUM APPROVAL SHEET

This practicum took place as described.

Verifier: David W. Markoe

David W. Markoe

Area Superintendent for Effective Schools
Title

Frederick, Maryland
Address

April 28, 1989
Date

This practicum report was submitted by Thomas J. Craney under the direction of the adviser listed below. It was submitted to the Ed.D. Program in Early and Middle Childhood and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Nova University.

Approved:

6 13 89
Date of Final Approval of Report

Georgianna H. Lowen (DS)
Georgianna H. Lowen, Ed.D., Adviser

ACKNOWLEDGMENT

Undertakings of the proportion of this practicum involve the complex coordination of human resources. The writer has been fortunate enough to be surrounded by, and receive support from, a variety of individuals and groups. First, and foremost, the writer thanks Bonnie Steele for her unrelenting support and encouragement, and perhaps most importantly, her friendship. For the opportunity to translate ideas into actions, appreciation is expressed to the Area Superintendent for Effective Schools, Supervisor of Special Education and Psychological Services, Curriculum Specialist for Elementary Language Arts, participating demonstration teachers, and to the school system more generally, for encouraging and supporting school-based staff development efforts. Special thanks are given to the school-based administrators and staff participating in the practicum process, from its inception to its evaluation. Gratitude is also expressed to Ned Herrmann for his inspirational contribution and his professional staff who provided the writer with technical assistance throughout the process. Finally, the writer would like to express his appreciation to his parents and family who have supported him in this, and every endeavor, his friends and colleagues for their encouragement, and his adviser for helping to bring practicum ideas to fruition.

TABLE OF CONTENTS

Page

ACKNOWLEDGMENT iii

TABLE OF CONTENTS iv

LIST OF TABLES viii

LIST OF FIGURES ix

ABSTRACT x

Chapter

I INTRODUCTION 1

Community Description and Demographics 1
Author's Work Setting and Role 3

II STUDY OF THE PROBLEM 6

Problem Description 6
Problem Documentation 8
Causative Analysis 12
The Related Literature 15
An Overview: Brain Physiology, Anatomy and Function
Basic Facts 16
The Triune Brain 17
Developmental and Sex Related Brain Function Issues 18
The Brain/Behavior Relationship 21
Cognitive and Information Processing Models 22
Metacognition and Thinking Skills 25
Hemisphericity and Functional Lateralization 27

Dominance, Preference and Style 31
Educational Implications of
Neuroscience Research 32
Definitions and Terminology 33
Adaptation and Remediation 35
Learning Styles and Cognitive
Processing Preferences 38
Assessment Practices and
Instrumentation 39
Herrmann's Instrument and Model 44
Matching and the Teaching/Learning
Relationship 45
Summary 51

III ANTICIPATED OUTCOMES AND EVALUATION
INSTRUMENTS 53

Statement of General Goals 53
Behavioral Expectations 53
Evaluation Instruments 54

IV SOLUTION STRATEGY 57

Discussion and Evaluation of Solutions 57
Description of Selected Solutions 62
Report of Action Taken 69

V RESULTS, CONCLUSIONS AND
RECOMMENDATIONS 74

Results..... 74
Conclusions..... 77
Recommendations..... 83
Dissemination..... 84

REFERENCES 86

Appendices Page

A DESCRIPTORS ASSOCIATED WITH LEFT-HEMISPHERE DOMINANCE AND PROCESSING 97

B DESCRIPTORS ASSOCIATED WITH RIGHT-HEMISPHERE DOMINANCE AND PROCESSING 99

C A COGNITIVE STYLES SCHOOL PROGRAM INSERVICE OUTLINE 101

D BASIC NEUROSCIENCE AND NEUROEDUCATIONAL RESEARCH INSERVICE OBJECTIVES EVALUATION INSTRUMENT 106

E BASIC NEUROSCIENCE AND NEUROEDUCATIONAL RESEARCH INSERVICE OBJECTIVES EVALUATION INSTRUMENT ANSWER-KEYS..... 114

F INDIVIDUAL HBDI PROFILE EVALUATION INSTRUMENT..... 121

G INDIVIDUAL HBDI PROFILE EVALUATION INSTRUMENT SCORING EXAMPLE..... 124

H HERRMANN FOUR QUADRANT LESSON PLAN EVALUATION CHECKLIST..... 127

I HERRMANN FOUR QUADRANT LESSON OBSERVATION CHECKLIST..... 130

J LOCAL INITIATIVES AND PROGRAMS CONSISTENT WITH PRACTICUM OBJECTIVES 133

K THE LOCAL SYSTEM'S COMMITMENT TO THE EFFECTIVE SCHOOL PROCESS 135

L PERMISSIONS TO USE THE HBDI AND HERRMANN MODEL SUPPORT MATERIALS 139

M EXAMPLE OF HERRMANN BRAIN DOMINANCE PROFILE AND CONSOLIDATED SCORE SHEET 142

N EXAMPLE OF HERRMANN BRAIN DOMINANCE PROFILE SCHOOL GROUP COMPOSITE 145

O HBDI PROFILE INTERPRETATION AND SUPPORT MATERIALS 147

P PARTICIPANT RESPONSE FORM 154

Q PARTICIPANT RESPONSE FORM COMMENTS 156

LIST OF TABLES

Table		Page
1	Referrals to School Psychologist as a Function of Teaching/Learning Styles Questions	10
2	Consultation Requests of School Psychologist Regarding Teaching/Learning Style	11
3	Summary of 59 Participant Response Forms Rating Basic Neuroscience, Neuro-educational Research and HBDI Presentations	79

LIST OF FIGURES

Figure		Page
1	Summary of Objective Evaluation Results	76

ABSTRACT

A Neuropsychological Consultation Model Designed to Foster Wholebrain and Cognitive Style-Responsive Instruction for "At Risk" Elementary School Students. Craney, Thomas J., 1989: Practicum Report, Nova University, Ed.D. Program in Early and Middle Childhood. Descriptors: Cognitive Style/Cognitive Mapping/Cognitive Development/Cerebral Dominance/Brain Hemisphere Functions/Lateral Dominance/Hemispheric Specialization (Brain)/Learning Modalities/Learning Strategies/Learning Processes/Teaching Methods

The practicum was designed to: promote an increased understanding of how neuroscience research impacts the teaching/learning process; promote an increased understanding of how practical applications of cognitive styles research can improve the teaching/learning process; help teachers to systematically employ wholebrain and responsive instructional approaches with "at risk" elementary and middle school students; and, to provide the theoretical/conceptual, practical and experiential knowledge base necessary for subsequent cognitive styles/preferences program development efforts.

Within the writer's public school system teachers were found to employ instructional methodologies that were not wholebrained or cognitive style-responsive. Causes were discussed and needs identified. Weaknesses in teachers' theoretical/conceptual and practical knowledge of the implications of cognitive styles research, led to the creation of a staff development program, the receipt of grant monies, and program implementation with the staffs of four elementary schools. Circumstances prevented the inclusion of middle school educators as planned. As a school psychologist, the writer served as coordinator, presenter and consultant.

The results of the practicum were positive, with three of the four objectives attained. Analysis of the evaluation data indicated that 7 out of 10 program participants completing the staff development program and the evaluation instruments were able to demonstrate their theoretical/conceptual knowledge of the cognitive styles/preference model. Nine out of 10 demonstrated understanding of their own cognitive style/preference and its implications on the teaching and learning process. Nine out of 10 participants successfully developed wholebrained and style-responsive instructional lesson plans, and 10 of 10 observed teachers demonstrated wholebrained lesson delivery within the context of their classrooms. Outcomes were discussed, recommendations made and dissemination plans presented.

CHAPTER I
INTRODUCTION

Community Description and Demographics

The geographical setting for the practicum was that of a rural/suburban county lying approximately forty miles outside a major metropolitan area with an approximate population of 115,000. During the past 40 years the county has experienced a dramatic increase in the rate of growth. Transitions made toward non-agricultural development have been fueled by improvements in transportation to metropolitan areas, expansion of the federal government and its related research-oriented businesses, and growing service and trade industries. Within the past 15 years the county has become one of the fastest growing jurisdictions in the State, with a 40% increase in its population expected during the next 15 years (League of Women Voters, 1986).

The organizational setting was the county's public school system. The district system is comprised of 24 elementary schools, 8 middle schools, 7 high schools, and 4 special schools (i.e., vocational-technical, special education). According to A Report of Student Participation and Achievement (Frederick County Board of Education, Department of Compensatory and Accountability Services, 1986) nearly 25, 000 attended

the county's schools. Approximately 10,750 students were in elementary schools, 5,300 in middle schools, 7,250 in high schools, and 360 in special schools at the time of the report in 1986. The student population has since grown by nearly 1,200 pupils. Racially, the county's student population was reported to be 92% white, 6% black and 2% other races (i.e., Asian - .7%, Hispanic -.5%, American Indian -.03%). Approximately 52% of the school district's student population are male. Male students are represented in significantly higher numbers in the populations of the district's special schools.

The schools in the county's largest city, also the seat of government, enroll larger numbers of minority students than schools located elsewhere in the district, with figures ranging from 28% minorities by race for a city elementary school to zero percent by race in two rural elementary schools. Of every 100 public school students, 13 of them come from families whose size and income qualifies for the Federal Lunch Program (Frederick County Board of Education, Department of Compensatory and Accountability Services, 1986). Ten percent of the elementary school population is provided with supplemental instructional services which, under Chapter I, serve to meet the needs of educationally disadvantaged students residing in attendance areas with a high concentration of low income families (9 elementary schools total). Eight percent of the school district's total population receives special education services, as mandated under Education for All Handicapped Children Act of 1975 (EHA).

The targeted individuals for the proposed practicum were from two groups within the educational organization. They included instructional personnel (i.e., regular and special education teachers, Chapter I teachers, reading specialists) who had responsibilities for teaching, particularly the

"at risk" students (i.e., special needs/handicapped, disadvantaged and minority students) within an elementary and middle school "feeder" pattern. The targeted feeder pattern included two middle schools into which five elementary schools fed. The second group of targeted individuals, depending upon programs and available resources, was comprised of building level administrators and instructional support personnel (i.e., school support teacher and guidance counselor), area-based teacher specialists, central office-based curriculum specialists, psychologists, special education coordinators and administrators.

Author's Work Setting and Role

The writer is a school psychologist employed by the county's Board of Education. Assigned to an administrative area and a feeder pattern of schools, this psychologist has responsibilities in nine schools, and serves a student population of approximately 6,000. In addition to the targeted feeder pattern of schools previously described, the writer has responsibilities in a high school and and alternative/ special education school.

Locally, psychologists serve on each school's multidisciplinary team (MDT), and on other level MDTs (i.e., regional and county) as appropriate, and are responsible for providing the teams with diagnostic and evaluative information necessary in the identification of special needs students, specifically those students suspected of being seriously emotionally disturbed, learning disabled and/or intellectually limited. In addition to psychoeducational evaluation and MDT responsibilities, the psychologist consults with individual students and parents regarding educational and developmental issues, and with administrative and

instructional personnel regarding a wide variety of teaching/learning issues.

Consultations most frequently take the form of questions concerning situationally appropriate instructional methods relative to a particular student's cognitive processing strengths and weaknesses and their subsequent educational needs. The products of these diagnostic/prescriptive consultations are often reflected in the development and implementation of an intervention plan or individualized educational program (IEP). Organizational level consultations are also requested of the school psychologist. Consequently, staff development and inservice education efforts are undertaken throughout the year at a number of organizational levels. The practicum, while larger in scope than the usual inservice and staff development services provided by this school psychologist, was executed under the writer's role as a consultant for organizational and staff development, particularly as it applies to the system's "Effective Schools" mission.

This writer has a Bachelor of Arts degree in psychology, a Masters of Arts degree in school psychology and an advanced graduate certificate in school psychology. The practicum was a requirement of the doctoral program in Early and Middle Childhood in which the writer was, at the writing of the proposal, a third year student. The writer has been granted the School Psychologist II/Advanced Professional Certificate by the State's Department of Education and has been practicing school psychology within the public schools for six years. This writer's related professional experiences include the contracted provision of counseling services (i.e., drug/alcohol and adjustment counseling) through a publicly supported

agency, and six years of clinical experience as a technician on inpatient psychiatric units in both military and private hospital settings.

Addendum

Over the course of the practicum process (proposal to final report) numerous organizational changes affected the proposed practicum design and its subsequent implementation. While many of these specific changes will be discussed more fully in Chapter IV, a key change will be mentioned here to provide continuity. The much needed hiring of an additional area-based psychologist resulted in a redistribution of assigned schools and the breaking of strict "feeder patterns." This writer maintained his pre-existing school assignments with the exception of the loss of a middle school and an elementary school.

CHAPTER II
STUDY OF THE PROBLEM

Problem Description

Educators have long recognized the need for alternative instructional approaches in order to meet the diverse individual needs of students within their classes, particularly those grouped heterogeneously. Teachers however, fail to systematically accommodate the unique learning styles of students. Over the last decade particularly, research related to instructional methodology has yielded extremely relevant findings, yet the transfer and practical application of these findings within the classroom has been slow and inconsistent. Educators find themselves caught between a theoretical notion of individual differences and a practical notion of dealing with the differences within the classroom (Bagar and Hoover, 1984).

Instructional accommodation is of particular importance when teachers are faced with students who are "curriculum casualties." Because their needs are not systematically met within the mainstream instructional delivery system, these students are "at risk" educationally. Accommodations in instructional approach are imperative when confronted with the student population that has already been excluded from an optimal

mainstream educational experience (i.e., special needs and Chapter I students).

General education teachers, and the teachers of "at risk" students specifically, lacked the theoretical understanding and conceptual knowledge of basic neuroscience as it related to the teaching/learning process. Cognitive processing styles/preferences had, for the most part, unrecognized importance for both the teacher and learner, and the interactive process which connected them.

Within the classroom setting, teachers relied upon instructional methods and strategies that appeared to be the product of previous learnings. However, like the process of learning, the instructional process was impacted greatly by the teacher's own cognitive processing style or preference. Group instruction was often "unresponsive" in that it did not take into account the composite or range of cognitive styles within the group. When faced with individualized instructional challenges, teachers did not systematically adjust their instructional methods and strategies to accommodate their students' group or individual cognitive processing strengths, weaknesses and/or preferences.

Teachers lacked an appreciation for how their cognitive processing style or preferences impacted their selection and implementation of instructional methodologies. Furthermore, without a basic understanding of neuroscience, learning styles and cognitive processing preferences, teachers chose group and individualized instructional approaches that were "unresponsive," from a neuroeducational perspective. Like other large educational institutions, the local system attempted to "fit" the student to the curriculum.

Ideally, all students, perhaps with the exception of a few extremely special needs cases (i.e., severely and profoundly retarded), could meet with success within the mainstream of educational experience. Possessing a basic understanding of neuroscience theory, concepts and educationally related research, teachers could responsively and systematically accommodate instructional methodologies based upon cognitive style orientation and the situational needs of their learners. This systematic approach could improve instructional effectiveness, increase the likelihood of curriculum objectives attainment, and could offer a delivery system that was consistent with the related concepts and movements of "least restrictive environment," "educational equity" "effective teaching/schools" and "rights without labels."

Briefly stated then, the problem was that teachers employed instructional methodologies that were unresponsive, from a cognitive style/preference perspective, because the targeted teachers lacked the theoretical and conceptual understanding regarding basic neuroscience and the practical implications of research related to the teaching/learning process.

Problem Documentation

Evidence of the identified problem mounted over the years the writer functioned as a school psychologist within the system. Initially, observations made by the writer indicated a paucity of cognitive style/preference responsive instruction. In an area newspaper, Armstrong (in Oldenburg, 1987) reported that the majority of public and private schools in America taught through linguistic and logical-mathematical approaches. The problem inherent in this system, however, is that students

who demonstrated poor verbal and/or logical skills often failed in school, despite their talents in other areas. Within the local setting, this writer frequently observed this systematic instructional bias. For example, "wholebrained" lessons were not often employed within classrooms, despite heterogeneous instructional groupings. Nummela and Rosengren (1986) reported that the "ordinary" classroom limits what the brain can do due to the reliance on the sequential instructional approach.

The problem, as described above, became increasingly clear to this school psychologist throughout assigned schools. Evidence of the needed instructional related consultation and/or staff development was obtained from two situation specific sources. The first was referral-based. When student learning problems are identified, school-based multidisciplinary teams often generate a referral to the area-based school psychologist. Subsequently, the school psychologist conducts an individual student evaluation in an effort to answer the "Team's referral questions to be addressed by the psychologist." The data in Table 1 reflects the number of referrals received by this writer during the 85/86 through the 87/88 school years, the number of referrals requesting specific information regarding individual student learning patterns (i.e., style) and/or suggestions regarding appropriate and effective instructional approaches, and their corresponding percentages. The data indicated that over 50% of the referrals received by this school psychologist included questions regarding teaching/learning style, with slight percentage increases noted over the course of 3 years, and within the referrals received from elementary schools. Examples of actual referral questions are listed in Table 1 as well.

Table 1

Referrals to School Psychologist as a Function of

Teaching/Learning Styles Questions

School Year	No. of Referrals for Psychological Eval.*	No. w/ Teaching/ Learning Questions**	Percentage
1985/86	251	147	53%
1986/87	278	158	57%
1987/88	336***	211	63%

* Number based upon referrals received by the writer, who served as an area-based school psychologist with service responsibilities in a "feeder pattern" comprised of nine schools (K-12).

** Number of specific questions regarding teaching/learning and style/preference found in the "Team's referral questions to be addressed by the psychologist" section of the referral form.

*** A disaggregated analysis of the total number of referrals for the 1987/88 school year revealed that of the 233 referrals that originated from the elementary school level, 195 (or 83%) included specific teaching/learning and style/preference referral questions.

EXAMPLES OF REFERRAL QUESTIONS

1. "What is an effective approach to reading with this student?"
2. "What is this student's learning style?"
3. "What instructional strategies will work best with this student?"
4. "What factors are affecting this student's ability to learn?"

The second source of evidence indicative of a need stems from the less formalized "requests for consultation." One of the school

psychologist's roles is to consult with school based personnel, usually teachers, regarding expressed teaching/learning concerns. The vast majority of consultations revolve around behavioral management issues. Second only to those related to behavior management, were consultations regarding instructional approaches that would help teachers "reach" specific students. Approximately one third of all consultation requests received involved issues related to teaching/learning and cognitive style/preference (see Table 2). Examples of consultation questions are also presented in Table 2.

Table 2

Consultation Requests of School Psychologist

Regarding Teaching/Learning Style

School Year	No. of Requests for Consultation	No. w/ Teaching/ Learning Questions	Percentage
1985/86	94	29	31%
1986/87	118	41	35%
1987/88	106	34	32%

EXAMPLES OF CONSULTATION QUESTIONS

1. "Why can this student do so well in one subject area yet so poorly in another?"
2. "How do I capitalize on the student's strengths in art?"
3. "What can I do to reach the student who doesn't seem to benefit from traditional instructional approaches?"
4. "Why is it that a handful of students in every class seem to need so much individual attention?"

In an attempt to determine the basis for the significant number of referral and consultation questions regarding teaching/learning styles, the writer found rather consistent needs. Follow up conferences with teachers, and administrators, helped this writer identify the teachers' need for greater conceptual knowledge regarding basic neuroscience, learning styles and cognitive processing preferences. This more general need was found in addition to their need for student and situation specific methodological recommendations. Many teachers had specifically asked this school psychologist to help them view the teaching/learning process from a cognitive styles/preferences frame of reference.

Causative Analysis

A great many things competed for a teacher's time during the school day. Non-instructional duties and paperwork, particularly that associated with special programs (i.e., federally funded), took their toll. Class size, with elementary grades averaging 24 students, had obvious ramifications for the type and quantity of student/teacher interactions within the classroom. Even during instructional time, the pressures and expectations from outside of the classroom (i.e., principal, BoE, community) had significant impact on classroom activities.

Maintaining the expected pace through the curriculum, assuring mastery in the skills identified for that particular grade level, and preparing students for the taking of standardized tests (i.e., Metropolitan Readiness and Achievement Tests, California Achievement Tests and the State minimum competency exams eventually) were among the most evident pressures felt by teachers locally. The centralized mandating of educational outcomes through standardized tests, content through

curriculum alignment and teaching methods through teacher evaluation criteria, set in motion a chain of events which impacted educational ends and means (Wise, 1988). Consequently, many teachers stopped teaching reading and focused on reading skills, or decreased higher level thinking skills by focusing on factual regurgitation.

Demands for accountability originating from federal, state and local levels, have had a tremendous effect on the everyday functioning within the classroom. These "centralized" pressures have become, at times, overwhelming to instructional personnel, and resulted in a focus on "doing things right" as opposed to "doing the right thing." This effective schools analogy serves to delineate responsibilities for student outcomes and clarifies the efficiency/effectiveness distinction. The progressive loss of discretion within the local system has resulted in reduced individualized approaches to instruction within the mainstream, and has resulted in increased "pull out" programs. This trend, Wise (1988) indicated, results in an educational environment that is characterized by standardized teaching, not professional discretion; standardized testing, not educational standards; and by teacher-proof curricula, not curriculum reform.

Torres and Katz (1983) reported that teacher preparation programs focus on assisting pre-service teachers in the development of content and subject areas rather than on the process of how to share information to promote and increase student learning. The impact of neuropsychological research had been, for the most part, overlooked in both the training and in the implementation of educational programs (Kinberg, 1983). The emphasis on curriculum "content" had hampered the focus on "process." The focus on criterion-referenced test results and outcomes had become an increasingly important aspect of curriculum and instructional delivery

system evaluation. That trend resulted in an emphasis on the "what," often at the expense of more "how" oriented perspectives. The curriculum was accommodated by systematically sorting students as opposed to the curriculum accommodating students. That process resulted in "curriculum casualties," or students who received their instruction "outside" the mainstream of educational experience. Equity concerns placed these students "at risk" educationally. As a result, students were not systematically exposed to instructional methodologies that accommodated and were responsive to their individual or collective cognitive styles or preferences. As Kinberg (1983) indicated, the social and human costs of this inequity in our educational institutions cannot be minimized.

Jenkins (in Keefe, 1988, p. 41) suggested that students in learning environments that do not offer appropriate alternatives or adaptations (most "traditional" classrooms) were forced to expend energy on the process of adjustment, which may have depleted the energy available for learning. Schools should, Jenkins submitted, be building upon the research and technological advances in the field, and should help teachers design, develop and implement more individualized instructional programs based upon individual learning styles. Instructional rigidity and a misunderstanding of different learning styles, Armstrong argued (in Oldenburg, 1987), resulted in the misplacement of countless children with no educational handicap into special education programs, and the labeling of many more as underachievers. Further, every student could become a successful learner if educators recognized and encouraged personal learning styles in the classroom. In Brophy's (1986) review of effective teaching literature, an apparent trend linked teacher behavior to student achievement, leading to the establishment of a relevant knowledge base for

the teaching profession to draw upon. This knowledge base needs to be expanded, but now helps answer questions like, how can teachers best accommodate individual differences in heterogeneous classrooms?

Sylwester (1981) reported that education majors tended to shy away from biology and chemistry courses, and that practicing educators don't read brain research. He concluded further, that brain researchers typically don't focus on the educational implications of their work, nor do they publish in education journals. Until recently, teacher preparation programs offered few courses related to applied neuroeducational research. Consequently, teachers lacked the theoretical/conceptual knowledge foundation in basic neuroscience, upon which the practical implications of cognitive style/preference research are based. Without an appreciation of the impact of cognitive style or preference on the teaching/learning process, teachers remained instructionally unresponsive with regard to this orientation. Organization and support related weaknesses (i.e., staff development opportunities, administrative support) also impeded the process of transition toward a more cognitive style responsive instructional delivery system.

The Related Literature

Good educators have always recognized individual differences within learners but have been at a loss for a theoretical foundation on which to base their understanding of these differences. Edmonds (1979) suggested that the great problem in schooling is that we often teach in ways that can keep some children from learning almost anything. Lacking conceptual knowledge, the accommodations and adjustments made in the instructional processes tend to be non-systematic (Lyons and Languis, 1986). The

information from cognitive neuroscience can only have an impact on the instructional process if teachers, through whom the process is channeled, develop an understanding of, and practical appreciation for, basic neuroeducational assumptions and concepts. Cognitive styles research has import for both teaching and learning.

An Overview: Brain Physiology, Anatomy and Function

Basic Facts

At the cellular level of examination the brain is comprised of some tens of billions of cells. The interconnections between neurons (synapses) in the top layer of the brain (neocortex) is reported to be 10,000 miles per cubic inch. Each neuron contains approximately 20 million molecules of RNA, which converts DNA into thousands of proteins which are at the core of the brain's chemical functioning (Sylwester, 1982b).

The brain accounts for about 2% of the body weight of an adult (about three pounds) but uses approximately 20% of the body's energy. It generates about 25 watts of power while a person is awake and slightly less when sleeping. Information is processed through trillions of connections at a speed equivalent to 250 miles per/hour. Sylwester (1982b) reports that every second, several billion bits of information pass through the corpus callosum, the 200 million neuron fibrous bridge that connects the hemispheres of the brain.

As a functioning organ the brain exists in the present with only a minute's lack of blood bringing about unconsciousness and eight minutes resulting in death. As a functional organ however, the brain exists in the past, present and future.

The Triune Brain

A vertical or evolutionary perspective of the brain reveals functioning through three distinct, interrelated areas, known in gross anatomical terms as the reptilian complex, limbic system and neocortex. These three areas comprise what is referred to as the triune brain system. The reptilian complex is the primal brain region and derives its name from its similarity to the structure of the brains of reptiles. It is located at the top of the brain stem and is primarily responsible for life support functions like circulation, respiration and consciousness. It is also felt to process very basic drives, habits and rituals (i.e., territoriality, fight or flight responses, nonverbal signals).

The structure at the base of the complex is called the reticular formation which serves as a complex gatekeeper, regulating the influx of incoming impulses. Attention, intent and motivation are felt to be closely tied to brain functioning at the reptilian complex level. As one might expect at this level of functioning, novelty and intensity seem to stimulate the reticular formation. While this continues to serve a very real survival need, more subtle implications are also suggested (i.e., attention getting ads, educational strategies).

Surrounding the reptilian complex are the structures of the limbic system. Socio-emotional functioning is felt to be mediated within the limbic system. Through regulation of hormonal discharges and related processes, the system maintains a given emotional state or level. Mood altering drugs for example, are felt to have the limbic system as their cite of action (Sylwester, 1982b). In fact, under certain conditions (i.e., excessive exercise) the body produces its own mood changing agent known as endorphins.

The limbic system is directly tied to smell and taste receptor areas and has been historically referred to as the "smell" brain. Specific structures of importance within the limbic system include the hypothalamus and pituitary gland. Through initiation and coordination of various hormonal and muscular responses the hypothalamus and pituitary are instrumental in mediating emotional behaviors (i.e., stress response).

The folded and convoluted part of the brain is known as the neocortex or new brain due to its recent development, evolutionarily speaking, relative to the other areas of the brain. The neocortex comprises approximately 85% of the human brain's mass and is responsible for higher order functioning (i.e., logic, problem solving, conscious control). The neocortex is rather obviously divided into two hemispheres, each of which is divided into four lobes: the frontal, parietal, occipital and temporal lobes. The corpus callosum is the nerve structure which bridges the two hemispheres, fostering the collaborative efforts of both hemispheres in their specialized information processing and problem solving functioning (Sylwester, 1982b).

Developmental and Sex Related Brain Function Issues

The brain is exceedingly flexible, particularly in the formative years of development. It is with the passage of time and experience that each individual develops a unique learning style (Kane, 1984). The learning of older children and adults is symbolic and derived whereas young children's learning is primarily manipulative and fundamental. The young child's learning Elkind (1988) contends, may also be characterized as permeable rather than compartmentalized (i.e., the subject areas of math, reading and art).

There is no timetable for the development of hemispheric specialization, but there exists a body of evidence which suggests the "beginnings" of specialization as early as a few months after birth (Fischer and Lazerson, 1984, p. 69). Research related to language acquisition and brain damage have led to theories regarding functional plasticity and "sensitive" periods. Preschool aged children sustaining damage to their language dominant hemisphere (most often the left) often develop language ability without difficulty. Elementary school aged children with left hemisphere damage may only experience a temporary loss of language. By mid-adolescence however, the apparent functional plasticity of brain is offset by hemispheric specialization. In a similar vein, the facility for learning language is most apparent in children between two and five years of age, and while the ability adheres to no fixed period, and lasts into adolescence, marked difficulties are experienced by language learners beyond the sensitive period. Some have argued this point when designing foreign language programs and curriculum, indicating the need for instruction at an earlier age than the "traditional" secondary level, which is at the upper extreme of the language sensitive period.

Sylwester (1981) reports that Epstein's research regarding periods of brain growth has potentially significant implications for educators. The final third of brain growth (weight) occurs between the preschool and schooling years (2-16+ years). The growth rate, however, is not continuous. It appears that the brain demonstrates short periods of rapid growth, laying the neural foundation for emerging cognitive abilities. These periods alternate with longer periods of very slow brain growth or dormancy, which are thought to reflect the process of integrating the newly developed cognitive abilities. Epstein's growth spurt orientation has been

regarded as physiological evidence in support of Piaget's theory of cognitive development. In preschool and school aged children, six-month spurts of brain growth are most frequently demonstrated between the years 2-4, 6-8, 10-12+ and 14-16+. These accelerated growth periods appear to parallel Piagetian periods of cognitive development (Fischer and Lazerson, 1984, p.574-575).

In a synthesis of Epstein's and Piaget's perspectives, Luria's theory of neurological development is not only based upon the physiological changes that occur with normal maturation, but also with functional changes (Obrzut and Hynd, 1983). While the belief that functional maturation parallels growth in various cortical areas has been affirmed by Luria's research, it is much too early to draw conclusions about how this information could or should be used within the educational setting.

Sex related differences of all types have long been the focus of scientific research and investigation, and brain development and function are no exception. In his comprehensive review of the literature, Fairweather (1976) reports that there are few convincing sex differences with regard to cognition and functional localization. Reportedly, factors like birth order, age, rate of maturation and culture serve to confound much of the research. Helfeldt (1983) however, reports that there are educational, medical and neuropsychological bases for differences between male and female learning behaviors. Helfeldt claims that sex-linked differences in brain functioning can be seen despite age and socio-cultural factors.

It appears that the lateralization of language function occurs earlier in females and may help to explain the findings which indicate that females more frequently activated both hemispheres than did males, when presented

with spatial conceptualization tasks. Males do appear to demonstrate hemispheric specialization earlier than females (Dean, 1984). This early lateralization of function for males however, is not without cost. Associations between learning disabilities and male sex have been consistently found in large studies (Adams and Yeargin-Alsopp, 1987). Males are 10 times more likely to suffer from language disorders (Dean, 1984) and 9 times more likely to be found "hyperactive" or reading disabled (Helfeldt, 1983).

The interhemispheric "advantage" seen within females may also be supported by evidence which has indicated the more mature development of the corpus callosum in females (Coulson, 1987, December). Another apparent advantage is seen in female brain growth. Research suggests (Sylwester, 1981) that brain growth spurts during the 10-12 year period occur earlier in females and result in about 3 times the growth found in similarly aged males. The reverse however, is true for the brain growth period between 14 and 16 years, which some believe is connected with math achievement differences found between males and females at this stage (high school) in their education. As researchers continue to investigate sex-linked brain functioning, educators need to come to an understanding of the educational implications of the cognitive processing differences found between males and females (Helfeldt, 1983).

The Brain/Behavior Relationship

The brain is awesomely complex and has defied comprehension over the course of human history. The study of the brain as a living, functioning organ has only begun within the past 50 years as a result of technological advances. The behavioral movement, seen in education, child

rearing and disciplinary practices, grew in prominence, in part, as a result of short- comings in the understanding of brain function. Behavior is overt and can be observed and measured with relative ease, whereas the brain's complex functioning is quite covert, carried on beneath the skull's surface. While the behavioral perspective has made significant contributions to the field of education particularly, its inherent limitations led individuals to seek greater understanding of the processes sandwiched between the stimulus and response. Das (1984) believes the question facing educators is, how are learning related mental functions mediated by neural processes? In the absence of adequate explanation, theorists inferred basic cognitive processes even though they could not be observed directly. As the technology for studying the brain improved, many inferences regarding cognitive processing were dispelled. Empirically based orientations (i.e., cognitive and information processing models) became helpful in providing much desired and needed understanding of the underlying factors that significantly impact the teaching/learning process (i.e., attention, memory, comprehension).

As the pace of technology quickens, particularly in the brain monitoring and analysis field, the information generated regarding the brain's functioning will continue to increase dramatically. Sylwester (1982a) believes the information explosion will, and to a certain extent already has, brought about a transformation of major proportions in the educational industry.

Cognitive and Information Processing Models

While a consensus within the field of education has not yet been achieved, Swanson (1987b) reports that much of the current research has

an implicit adherence to a theoretical infrastructure, namely the information processing models of memory and cognition. Wittrock (1985) believes that fundamental improvements in education will come from teaching learners strategies to enhance their attention, motivation, memory and comprehension, as well as their ability to direct and control these processes. Information processing models have already provided the foundation on which instructional approaches like individualized instruction, diagnostic-prescriptive teaching, instruction based on strengths, remediation of weaknesses and multisensory instruction are based (Meyers, 1983).

From an information processing point of view (Obrzut, 1981), learning is a hierarchy of information processing involving sensation, perception, memory, symbolization, and conceptualization. Swanson (1987a) reports that the three general components that underlie information processing theory are: (a) a structural component, which is analogous to computer hardware and ultimately defines the parameters of information processing; (b) a control strategy, like the computer software which serves to describe the operations; and (c) an executive process, by which the learner's activities are monitored (i.e., performance feedback, strategy evaluation). Information flows through the system in a sequence of stages. Breakdowns in processing at any level within the hierarchy (i.e., perception), or at any stage (i.e., structural component/head trauma) may be related to learning problems.

Information processing models have provided the theoretical framework for much of the recently conducted research involving learning disabled (LD) students. The definition of LD, as Bireley and Hoehn (1987) have pointed out, has changed over the years, but has maintained the

emphasis on deficits rather than the strengths of a student. They suggest that the learning styles of LD students particularly, should not be overlooked as a dimension of the individualized teaching/learning process. The efficient academic performance required of students requires them to integrate several kinds of mental capabilities, and LD children do not efficiently incorporate and/or coordinate mental components into final correct responses (Swanson, 1987b). Chall (1981) reports that learning disabilities stemming from neuropsychological factors are best treated with appropriate instruction.

In a review of the LD related research, de Bettencourt (1987) concludes that LD students can be characterized as strategy-deficient, inactive learners. Specific deficiencies in the cognitive strategies of LD students were also found by Kolligiam and Sternberg (1987) and Telzrow and Speer (1986) and were reportedly responsible for their inability to selectively encode, compare and combine information, particularly at the automatic level. The research of Cermak (1983) reveals that both the rate and level at which LD children process, retain and retrieve verbal information are below that of their nondisabled peers. Slower processing has also been demonstrated in the dyslexic student population (Samuels, 1987), where processing limitations during a reading task appear to interfere with the individual's ability to simultaneously decode text and process it for meaning.

Neurological and functional intactness is fundamental to academic success in traditional classrooms where the interest of the group often times ignores individual differences (Kinberg, 1983). Deficits in processing may be addressed by either remediation skill work or through alternative forms of instruction that make more use of processing strengths. For the

educator however, it is important to determine if an identified weakness is "processing" or "strategy" based (Kirby and Robinson, 1987).

The research findings call for, as Telzrow and Speer (1986) and Johnson (1987) point out, a systematic focus on learning environments and specialized instructional techniques which emphasize the learning "process," the techniques for lifelong learning. With regard to instructional interventions more specifically, Hartlage and Telzrow (1983) report the need for a neuropsychological model based on the functional dichotomy of cognitive processes (i.e., sequential/linguistic versus simultaneous/visual-spatial). While the underlying nature of learning disabilities is yet to be fully understood, the use of neuropsychological procedures to identify the construct underlying learning disabilities will contribute greatly to the general understanding of this population (Obrzut and Hynd, 1983).

Metacognition and Thinking Skills

Metacognition is described (Stevens, 1987) as a two-part phenomenon comprised of: (a) a knowledge about one's self as a learner (cognitive processes); and (b) the regulation and control of learning behavior. Related to metacognition are strategies, which are plans consisting of a set of steps, used flexibly and adaptively, depending upon the situation (strategic), to perform a particular task. For example, the "Cognitive Behavior Modification" (CBM) program and procedures have been developed for the purposes of teaching general cognitive and/or metacognitive strategies rather than specific skills or content (Tarver, 1986). The focus of the approach is on the "how" of the learning process not the "what."

Wong (1986) offers a comprehensive overview of the metacognitive movement, particularly as it applies to the special education population. And, while limitations of the metacognitive approaches are discussed, Wong reports the appropriate and effective use of metacognitive processes in the understanding of reading related problems among mildly handicapped (LD and EMR) students. It has been demonstrated (Wiens, 1983) that metacognitive skills, comprehension skills and motivation are interdependent and by improving a student's metacognitive skills, improvements are seen in the other areas. Stevens (1987) reports numerous studies which indicate increased learner effectiveness on reading, memory and problem solving tasks, when metacognitive approaches have been employed.

The development of procedures and programs to enhance thinking skills have been on the increase over recent years. Yet, as Nickerson (1981) cautions, it will be some time before educators understand the implications of the results of their efforts. Theoretical perspectives need to be supported empirically before practitioners will feel comfortable incorporating new knowledge and skills into their professional repertoire. Learning strategy instruction must be in concert with desired cognitive outcomes, must take into account both the learning strategies and learner processes, must match a particular learning strategy and the learner's specific knowledge and skills, and must include a mechanism for performance feedback (Levin, 1986). Intelligence itself, as viewed by Sternberg (1981), is a set of thinking and learning skills that potentially can be separately diagnosed and taught. Researchers in information processing and thinking skills will help bring about the needed transition form theoretical to practical.

Hemisphericity and Functional Lateralization

A tremendous amount of research has been conducted over the last 50 years with its focus being the relationship between the brain and behavior. Over 100 years ago localization of function studies were being undertaken. During the 1860s the loss of expressive language abilities was found to be related to left hemisphere damage. The French surgeon Broca, found that the damage was most often localized in the left hemisphere's frontal lobe, which has come to be referred to as "Broca's area." Approximately a decade later a German neurologist, Wernicke, found receptive language abilities localized in the left hemisphere as well, however in the temporal lobe. Consequently, this language comprehension area has become known as "Wernicke's area" (Springer and Deutsch, 1981).

Localization of function studies and the study of brain injured individuals specifically, have lead to theories of hemispheric specialization. Penfield, a Canadian neurosurgeon, began using electrical stimulation of the brain during the 1930s as a technique for brain mapping and localization of function. Wada developed a technique for temporarily anesthetizing one hemisphere. These techniques were developed to prevent neurosurgeons from damaging the speech and language centers of the brain while performing brain surgery to control, for example, seizure disorders. Orton proposed a theory of cerebral dominance which was felt to explain mirror writing and "dyslexia." The theory's contention was that mixed hemispheric dominance led to mirror images in the hemisphere nondominant in language, which resulted in a confusion of language symbols (Springer and Deutsch, 1981).

Hemisphere related research gained much of its impetus from the "split-brain" research of Roger Sperry. Sperry and a team of researchers, pioneered a surgical technique where the electrical activity of one hemisphere was kept from over-stimulating the other hemisphere during a severe seizure. Epileptics underwent a commissurotomy, or the cutting of their corpus callosum (Webb, 1983). The procedure helped control the spread of seizure type electrical activity between hemispheres. However, to a large extent it also prevented more normal interhemispheric communication. Further investigation of "split-brain" patients revealed discrete characteristics of functioning, and even consciousness, between the hemispheres.

Examining the hemispheric differences more closely using specially designed experiments and questioning techniques, Levy reconceptualized the language/nonlanguage hemisphere dichotomy. The functional differences found between the hemispheres are felt to reflect "approach" differences not actual aptitude differences (Webb, 1983). By and large, the left hemisphere was found to be analytic in its approach, whereby the right was holistic in its problem solving strategies. Consequently, this conceptualization has led to more sophisticated and discriminating investigation whose findings continually contribute, although not always in a consistent direction, to our current knowledge base. There exists a plethora of information regarding cognitive processing and the learning process more generally. Those working in the field agree that existing data has significant implications for the field of education.

It is now generally agreed, (Obrzut, 1981) that hemisphere distinctiveness lies not so much in the functions (i.e., language) each mediates, but in how (i.e., cognitive mode) the information is processed.

While a simple dichotomy cannot reflect the complexity of brain function, the split-brain metaphor is quite useful in the simplistic summarizing of research findings (Hopkins, 1984). In right-handed individuals (approximately 95%), the left hemisphere's mode of processing is said to be sequential, analytic and linguistic (see Appendix A). The left hemisphere is frequently referred to as the rational mind because it is where most individuals process rational and abstract thought (Sylwester, 1982b). It analyzes incoming data sequentially and is instrumental in processing language, arithmetic and inductive problem solving. The type of processing conducted by the left hemisphere is systematically emphasized in our culture and educational institutions (i.e., language and math oriented techno-culture).

As the hemisphere said to process data from a relational perspective, the right hemisphere has come to be known as the metaphoric mind. Simultaneous and spatial processing serve the right hemisphere's holistic orientation (see Appendix B). The "products" of right hemisphere functioning have often been described as creative and/or innovative and are often associated with the arts (i.e., music, drama, art). The principle upon which data are organized in the right hemisphere is structural similarity, unlike the conceptual similarity organization found in the left hemisphere (Obrzut,1981).

While the functional lateralization model may best be thought of as a metaphor for actual brain activity and specialization, it becomes a useful conceptual tool when looking at the cognitive processing styles/preferences of individuals as related to the teaching/learning process (Yellin, 1983). For example, Dunn, Cavanaugh, Eberle and Zenhausern (1982) made a case for matching learning and teaching styles and found increases in

achievement when hemispheric preferences were accommodated instructionally. Sylwester (1982b) reports that the best kind of learning and teaching activities combine the tremendous capabilities of both hemispheres whenever possible (seeing the forest and the trees). And, the best curriculum is one which contains both words and ideas, sequences and wholes, analysis and synthesis, space and time.

While the hemispheres can and do function independently from one another, as demonstrated in the research with "split-brains", the corpus callosum can and does effectively integrate the two hemispheres (Kane, 1984). Therefore, practitioners must realize that instructional activities need to stimulate cerebral functioning bilaterally, in order to maximize an individual's potential. However, schools have neglected or systematically eliminated many "right-brain" experiences (Hopkins, 1984), which results in a curriculum that, Rennels (1976) says, serves to sever the corpus callosum functionally. Sperry has stated that modern science and our educational system discriminate against the right hemisphere and the nonverbal form of intellect (Gaddes, 1985, p. 209). Wittrock (1981) finds the popular notion of teaching to one or the other hemispheres of the brain unfortunate. It isn't a question as to which hemisphere to educate, but rather how to capitalize upon functional asymmetry. Numella and Rosengren (1986) report that methods which encourage the use of both hemispheres can be taught in teacher education programs.

Identified in the research (Hiscock and Kinsbourne, 1987) are conceptual and methodological problems which have undermined efforts to find a reliable association between cognitive characteristics and hemispheric specialization. Hiscock and Kinsbourne argue that cognitive style lies at the behavioral level of analysis and should not be assumed to

reflect physiological or anatomical characteristics. They conclude left- and right-hemispheric cognitive styles are metaphors without a proven neurological basis. However, evidence in support of the metaphors will be presented throughout the literature review to follow.

Dominance, Preference and Style

The left-brain/right-brain metaphor used to describe the functional lateralization of the cerebral hemispheres, may best be understood through terminology clarification and analogy. Cerebral "dominance" had been thought of as the language specialized or "major" hemisphere, usually the left. This belief was likely the result of the emphasis placed on linguistic and mathematical abilities within our culture. However, research has found that the "minor" hemisphere is dominant when individuals are presented with spatial-perceptual-constructional tasks. Therefore, dominance may be situation specific or mixed, and may be defined by the nature of the problem solving tasks, or measurement instruments.

Related to the concept of dominance, is that of preference. Lateral preferences are those characteristics that are more readily observed in one's behavior (i.e., handedness, footedness, eyedness). Although individuals can voluntarily choose which hand to use while throwing a ball, for example, they usually prefer one hand over the other. Likewise, individuals usually prefer particular problem solving approaches or strategies, felt to be, metaphorically at least, characteristic of one of the hemispheres (i.e., left-brained, language oriented or analytical). Hence, the concept of hemispheric preferences. There is, however, a more physiologically based rationale for the analogy between motor lateralization (hand preference) and the lateralization of cognitive function.

Generally speaking, the motor behavior of one side of the body is controlled by the opposite or contralateral side of the brain. The relationship between the lateral preference of hands, or handedness, and cerebral specialization may be of interest to educators. Right-handers are left-hemisphere dominant for language approximately 95% of the time, with the remaining 5% being right-hemisphere dominant. Left-handers, however, demonstrate greater variability. Approximately 61% are left-hemisphere dominant for language, 19% right-hemisphere dominant, and 20% demonstrate bilateral dominance for language (Gaddes, 1985, p. 212).

Knowing which hand an individual prefers and which hemisphere is dominant for a specific type of processing (i.e., sequential versus simultaneous), offers little insight into the individual's cognitive processing preferences or style. Cognitive processing preferences or cognitive style may be determined through the systematic examination of behavioral patterns or, using appropriately discriminating tasks and questioning, diagnostic and self-report instruments. This writer views the concept of preference as one subsumed under the more encompassing concept of style. Cognitive "style" may be thought of as the patterns of behavior most characteristic of the individual's usual processing. Like habits, an individual's style is not cast in stone; change is not precluded.

Educational Implications of Neuroscience Research

Sylwester (1982a) suggests that two critical tasks face educators: First, teachers must become aware of the rapidly growing discoveries in the development, organization and operation of the brain; second, they must begin to think about how this information can be assimilated into the profession. The impact of this new information is likely to accelerate the

educational change process, particularly if educational consumers (i.e., the parents of school aged children, the business sector) are educated regarding adaptations and applications that have the potential for affecting the quality of education. The impetus for using neuropsychological data to understand and to ameliorate learning related difficulties comes from, as Das (1984) suggests, educators' willingness to look inside the proverbial "black box." While behavioral perspectives in education have greatly influenced educational policies and practices, educators may emerge from a period of floundering to build a useful theory that is oriented to demonstrable educational outcomes, while based on the scientific knowledge of the organ for learning (Hart, 1981). It is the new understandings of the organ (i.e., triune brain, hemispheres, growth and development), despite strikingly different styles and strategies, that Hart believes will bring about a more sophisticated level of school organization and practice.

Definitions and Terminology

In their review of the related literature, Smith and Renzulli (1984) found a wide range of definitions used to describe the construct of learning styles. The definitions range from a focus on preferred sensory modalities (i.e., visual, auditory, kinesthetic, tactile), to more personality and trait-based factors which have implications for behavior within specific learning environments (i.e., introversion vs. extraversion, intuitiveness). Information processing models have been primarily concerned with the processes of attention, memory and cognition and have led to research in the areas of conceptual tempo, strategies selection and thinking skills. In their consolidated description of learning styles as proposed by other authors, Bireley and Hoehn (1987) state that learning styles are those

normal variations in internal and external preferences for the setting and manner in which learning takes place.

Gregorc & Butler (1983) suggest that most researchers who are concerned with style agree with at least one aspect of Keefe's definition. Keefe (1988) describes "learning style" as the umbrella term encompassing affective and physiological/environmental and cognitive dimensions of the learner. The composite of characteristics serves as a relatively stable indicator of how a learner perceives, interacts with, and responds to the learning environment. Learning style is seen in the pattern of behavior and performance by which an individual approaches learning tasks. Neurological, personality, developmental and experiential factors are responsible for the molding of individual learning styles.

Affective styles are the motivational processes (i.e., expectancy, reward) which are viewed as an individual's routine mode of arousing, directing and sustaining behavior. Physiological/environmental styles are biologically-based response patterns determined by genetic differences (i.e., sex linked), personal nutrition and health, and accustomed reactions to the physical environment. Cognitive styles, also commonly referred to as cognitive processing preferences, are the information processing habits which are characteristic of an individual's typical mode of perceiving, thinking, remembering and problem solving (Keefe, 1988).

Greater clarity and specificity in the definitions of learning style is called for by many researchers. Hyman and Rosoff (1984) argue that some definitions raise more questions than they answer, while others do not focus on behavioral characteristics that can be observed in a student's learning. As Gregorc and Butler (1983) have indicated, terminology varies from researcher to researcher. Definitions are often comprised of

constructs that are not clearly defined. Even when differences are operationally defined, researchers and practitioners often interchange words that are not synonymous (i.e., learning style vs. cognitive style, right vs. left-brain). The criticism of Keefe's definition leveled by Hyman and Rosoff (1984) is that while types of behavior are offered generally, there exists no specific identifiable behaviors, or an operational way to determine these behaviors. Although there are advantages and disadvantages to any given definition or model, Gregorc and Butler (1983) warn instructional leaders that while there is no commonly accepted definition of style, the concept will evolve through many level of understanding, which will result in its effective use within the schools.

Adaptation and Remediation

A national task force, formed following a cognitive/learning style and brain behavior conference co-sponsored by the National Association of Secondary School Principals (NASSP) and St. John's University of New York, debated the merits of remediational versus adaptational approaches to style (Keefe, 1988). The focus of change varied depending upon orientation and perspective. Adaptationists felt that the factors external to the child (i.e., environment, materials, instructional methodologies) should be manipulated for optimal learning. The more psychologically oriented task force members felt that an emphasis needed to be placed on retraining the learner and developing cognitive skills that are effective in meeting the demands of the learning environment (Previously discussed under "Metacognition and Thinking Skills").

In their review of neuropsychological treatment approaches, Hartlage and Telzrow (1983) identified three major ways of matching

treatment approaches with learner aptitudes (aptitude-treatment interaction or ATI). Remedial approaches are those in which instructional interventions are aimed at deficit areas. The remediation trend, Das (1984) reports, can be traced to the research of Vygotsky, his notions of child development and the construction of control processes, and Feuerstein's beliefs about intentional schemes of interaction. Remediation efforts presuppose that inherited intellectual capacity is not necessarily related to educability. The second approach, capitalization, focuses upon learner strengths. Bargar and Hoover (1984) suggest that the first approach to students' learning problems should be through their strengths. The third type of approach is described as compensatory or circumvention oriented. This system of intervention parallels the "adaptive" orientation described above, and may be subdivided into internal and external approaches (i.e., learner versus environmental adjustments.

Keefe (1988) reports that task force agreement was made on the following: All students benefit from both a responsive and adaptive learning environment and from augmentation of their learning skills; some students will require more augmentation than adaptation; and some students will profit most when the learning environment is carefully matched to their personal learning style.

While it is possible to undertake both remediation/augmentation and adaptation within a given setting, an emphasis on adaptation may initially serve as a developmental stepping stone for more learner-oriented remediational approaches. While it has been a commonly held belief that "teachers teach the way they were taught," research (Dunn & Dunn, 1979) indicates that teaching style corresponds more closely to the individual's learning style. Thus, before an instructor can effectively remediate

identified cognitive processing weaknesses in a learner, an awareness and appreciation of one's own characteristic learning patterns, preferences and style is necessary. Lyons and Languis (1984), in studies of neuroscience/learning style pre-service teacher education programs, found that an awareness of one's own learning style/preference is a necessary prerequisite to identifying others' learning styles/preferences. Therefore, remediational techniques can only be effectively undertaken after one becomes aware of his/her own style. It would appear that the utilization of effective remediation efforts presupposes an appreciation for one's own style and adaptive capabilities. Lyons and Languis (1985) found that teachers who became aware of their own learning style tended to show improved understanding of the styles of others, which lead to more systematic adjustments in the teaching/learning process. After all, learning style and teaching style are interrelated.

Several steps have been suggested for bringing about such a process. Awareness raising sessions serve as a preliminary organizing function for more formalized knowledge and comprehension building efforts. The need for a common language is of particular importance. At the next step, self-application is facilitated by administering an appropriate style indicating instrument to the personnel involved, interpreting the individual profiles as appropriate. As teachers begin to apply their knowledge within the practical context of their classrooms it becomes imperative that teachers be supported in their efforts (i.e., administrative).

Ultimately, the same process should occur within the classroom when the focus of a styles program shifts from an adaptive emphasis alone to one which incorporates remediation approaches. Paralleling the steps described above is the process within the classroom. Students discuss individual

learning styles (awareness building); they are presented with the concepts and language of learning styles (common knowledge and language base); they apply their knowledge in the personal sense following the administration and interpretation of a learning style instrument, and finally, they are supported in their efforts to employ alternative approaches to learning and problem solving tasks within their environment. The trend in education related to the teaching of thinking skills is closely tied to the remediation perspective held by the learning style proponents.

Learning Styles and Cognitive Processing Preferences

Several avenues of investigation have been pursued that attempt to "make sense" out of the brain/behavior relationship, particularly as it applies to the teaching/learning process. Unfortunately, psychologists were abandoning the topic at the time when educational practitioners were becoming aware of the potential of learning style analysis (Keefe, 1985). The assessment of learning style variables has been undertaken at various levels and to numerous degrees by educators throughout the country over recent years. The variables assessed ranged from environmental preferences (i.e., light levels, temperature) to more cognitively oriented factors, yet have often reflected information at a superficial level (Keefe, 1985). The field has been fragmented, lacking a collaborative thrust as Keefe puts it, with little agreement on the conceptual issues.

Petreshene (1982) reports case studies where teaching to students' sensory strengths improved their classroom performance. Studies involving modality preferences and instruction however, have revealed inconsistent findings (Meyers, 1983). This may speak to weaknesses in the modality assessment process or the concept of modality matching.

Cognitive processing preferences (i.e., sequential vs. simultaneous) may offer a more theoretically accurate depiction of processing. Within the language of many educators today, descriptions of learners' strengths and weaknesses in "sensory processing" terms (i.e., an individual being an auditory or visual learner) have given way to more cognitively oriented or information processing based descriptions.

Most classroom teachers have been taught to relate academic learning to norm referenced standards, with little understanding of the importance and impact of individual learning styles (Davis and Quick, 1981). Weaknesses noted in the individualized educational programs (IEPs) of handicapped students for example, often revolve around the teachers' failure to relate teaching strategies to the learning strengths and weaknesses of their students. Good teachers have always been aware of their need to adjust their methods of instruction in order to accommodate individual learner characteristics, yet it has been the learning styles model which has provided the conceptual foundation from which a systematic departure could be taken (Smith and Renzulli, 1984).

Assessing learning styles provides today's teachers with a new direction to take toward developing a more personalized form of instruction (Henson and Borthwick, 1984). When coupled with an appropriate teaching style, the assessment provides the basis for greater improvement in student learning.

Assessment Practices and Instrumentation

Learning styles assessment can help educators focus their attention on the instructional strategies and techniques that are most effective (i.e., outcome driven) with their class (heterogeneous grouping), a small group

(homogeneous grouping) or individuals. It appears that assessment practices and instrumentation fall into one of three broad categories, depending largely upon their theoretical orientation and the purpose of the endeavor. The neurologically based model requires the use of relatively sophisticated instruments by highly trained professionals and technicians. Using a sophisticated electroencephalograph (EEG) process known as "Brain Electrical Activity Mapping" (BEAM) researchers have sought a "brain print" (Restak, 1986). The computer enhanced depiction of brain activity not only reflects differentiated hemispheric activity, but also more subtle localized functioning and anomalies. Researchers (Turner, 1987) are using the brain mapping technique to detect epilepsy, brain tumors and more elusive dysfunctions like "dyslexia" and learning disabilities. Similarly, neurometrics (John, Prichep, Fridman and Easton, 1988) uses a statistical analysis of the brain's electrical activity relative to normative developmental data to detect subtle cognitive dysfunctions, as well as more pathological conditions (i.e., neurological and psychiatric disorders). While these assessment approaches have been hailed for their solid empirical foundations and objectivity, they are beyond the practical reach of most, and the relationship between the findings and subsequent treatment is not yet clear.

The second type of practices and instrumentation is that which is neuropsychologically oriented. Using these approaches, an individual's behavior is usually observed within a highly structured, and often standardized, task-oriented context. Following an analysis by trained psychometricians, inferences are drawn regarding processing aptitudes, patterns and style. Neuropsychological assessment procedures have become increasing popular within school systems because of the increasing

population of identified learning disabled and neurologically impaired students which the systems are responsible for educating (Obrzut, 1981). For example, school psychologists have long recognized the value of the Wechsler Intelligence Scale for Children-Revised (WISC-R) as a neuropsychological instrument. At first glimpse, the WISC-R's Verbal and Performance Scales appear as dichotomies reflecting left/right-hemispheric functioning. However, as Obrzut (1981) has cautioned, many of the Performance Scale tasks do not tap right-hemisphere functioning solely, and are more likely reflecting a dynamic integration of the cognitive processing of the two hemispheres.

Dean (1984) feels the verbal-nonverbal distinction between processing may reflect an overcharacterization of hemispheric specialization. Incorporating the concepts of sequential versus simultaneous processing may make the hemispheric specialization metaphor more acceptable. The Kaufman Assessment Battery for Children (K-ABC), with its foundation in neuroeducational research, is an intelligence and problem solving instrument designed to assess successive and simultaneous processing (Obrzut, 1981). This instrument is theoretically sound and offers insights into children's cognitive processing beyond presently available measures of intelligence (Dean, 1984).

Neuroeducational assessment practices and instruments are the third general type, and include those which rely upon less sophisticated measures (i.e., self-report) and interpretation. Perhaps ironically, these procedures hold the greatest promise for educational practitioners. Several instruments are currently available to teachers which help them to identify students' learning styles and preferences. Most can be administered to a large group in a short period of time. When interpreted properly, these

instruments provide teachers with objective information which often reinforces or clarifies teachers' intuitive understanding of student learning styles.

The National Association of Secondary School Principals (NASSP), Monk and Keefe (1986) were instrumental in the development of the Learning Style Profile (LSP). The instrument was designed for use with students in the sixth to twelfth grades. Results profile 24 independent subscales representing 4 higher order factors: cognitive skills, perceptual responses, study, and instructional preferences. Teachers find profiles, individual and group, helpful in organizing instruction around identified strengths and weaknesses.

The Learning Style Inventory (LSI) is a popular self-report instrument that was developed for use with students in the third to twelfth grades (Dunn and Dunn, 1979). The adult version of the LSI is the Productivity Environmental Preference Survey (PEPS). The instruments are used to diagnose the individual learning characteristics in the following general domains: environmental; emotional; sociological; and physical. Results are reported to lead to prescriptions that complement selected styles so as to facilitate academic achievement.

Reynolds, Kaltsounis and Torrance (1979) presented preliminary data on a children's form of "Your Style of Learning and Thinking." The instrument is based upon research findings regarding information processing preferences with regard to the two cerebral hemispheres. Dunn and Dunn (1979) review several of the instruments available to teachers, noting their respective orientations and applicability (i.e., age appropriateness). Specific educational adaptations, like Carbo's (1987)

Reading Style Inventory (RSI), are also available and closely parallel the more general learning and cognitive style instruments.

The Myers-Briggs Type Indicator (MBTI) may be one of the most popular instruments used today. With a Jungian psychological orientation, this self-report instrument generates ratings on four dichotomous scales (Extraversion-Introversion, Sensing-Intuition, Thinking-Feeling, and Judging-Perceptive). Its use is limited to adults primarily, but the instrument is useful in the style awareness development process. The Murphy-Meisgeier Type Indicator for Children (MMTIC) parallels the MBTI, but is for children. The authors developed the instrument using the Jungian model in an effort to meet the need for a method to identify individual learning styles useful in instructional settings. Mamchur (1984) reports that knowing the psychological types of students helps teachers better understand and reach the learner. In their review of the literature, Bargar and Hoover (1984) found major implications for understanding differences in teaching and learning styles using the psychological types theory.

Researchers sometimes use a combination of assessment techniques. Lyons and Languis (1984) used a neural processing dichotomy (EEG), test of field dependence/independence and personality type using the MBTI, to evaluate the learning style profiles of prospective elementary teachers. Here, the assessment procedures were aimed at pre-service teachers, the premise being that before teachers develop an awareness of the students' individual learning differences and potentials, they had to become more sensitive to their own learning behaviors and how these affected their teaching.

Herrmann's Instrument and Model

An instrument of particular importance to this practicum was the Herrmann Brain Dominance Instrument (HBDI). As a corporate sponsored adult educator, Herrmann came to realize the potential value of understanding individual cognitive styles as related to the design and delivery of educational programs. However, the unavailability of a valid, reliable and cost effective instrument to measure such characteristics during the mid-70s prompted Herrmann to pursue ideas regarding the development of a self-report paper and pencil instrument. Over the course of the next decade, Herrmann worked to develop a instrument that would accurately assess the "brain dominance" characteristics of individuals, hence the HBDI (Herrmann, 1984).

Serving as the foundation for his research and instrument development efforts Herrmann developed a model for conceptualizing the brain dominance characteristics of individuals particularly as they related to the teaching/learning process. The four quadrant brain dominance model is described as a blending of the hemispheric specialization and triune brain concepts into a physiologically based metaphor of how the brain works (Herrmann,1986). Employing the metaphor, as Sylwester (1981) has reported, is particularly useful when introducing brain related research to educators with limited scientific background. The Herrmann model capitalizes upon brain related research and addresses preferential functioning not only in terms of the two cerebral hemispheres but also the two lobes of the limbic system. In addition to the four discrete quadrants, a more global perspective may be characterized by more dichotomous left/right or cerebral/limbic functioning. James (Undated) reports that it is the HBDI's face and predictive validities that make the implications of the

instrument's findings easy to understand. In studies conducted by James, parallels have been found between the HBDI and the MBTI. While the HBDI focuses primarily on brain functioning and cognitive processing, the MBTI incorporates factors which are felt to lie within the "personality" domain.

Matching and the Teaching/Learning Relationship

Student-centered teaching methods were introduced in America during the last quarter of the 19th century by Francis Parker, who was later described by John Dewey as the father of the progressive education movement (Henson and Borthwick, 1984). Empirical research methodology was not used to improve teaching methods until well into the 20th century. Research focused largely on learner behaviors. Prior to 1950 research focused on the learner and curriculum content, with little emphasis given to the teachers' role in bringing about desired learner outcomes. The dominant role of intelligence in learning was being challenged. Researchers were coming to find, as Das (1984) reports, that inherited intellectual capacity was not necessarily related to educability.

It was the research of John Carrol that found when a variety of teaching approaches and students were given all the time they needed, educational tasks were mastered. Subsequent research by Bloom and others, resulted in the development of numerous systems of instruction with an individualized focus, perhaps the most familiar being that of "mastery learning." The variations once attributed to the learner (i.e., intellectual ability), and seen as influencing outcomes, were in essence transferred to the teacher and the instructional process employed. Even the time students took to attain mastery was viewed as a function of the

students' own preferred learning styles and the teaching styles used to accommodate the learner.

Despite decades of investigation and research on teaching styles, student-teacher interactions, etc., we are only beginning to discover the nature of "good teaching" (Fuller and Glendening, 1985). Educators who shed past confusions to see the brain as the organ for learning enters an enchanting new world (Hart, 1981); and, with this focus on the brain and its function in the learning process, the field of educational neuroscience emerges. As a result of this new field, the need for a professional "translator," who will help with the interpretation and practical application of the research findings within the educational context, is also becoming apparent. Fuller and Glendening propose the "neuroeducator" as the professional of the future. To some extent this has already come to fruition, in that this writer functioned as a neuroeducator, albeit in the limited sense, through consultation and the practicum process.

The logic underlying the approach of matching learning and teaching is compelling because learners differ in many respects and are likely to respond to instruction differentially. The idea of accounting for and matching teaching/learning styles embraces the concept that both students and instructors are accountable for learning (Friedman and Alley, 1984). The styles movement is based in the progress made toward recognizing the varying needs and characteristics of the learner. Doyle and Rutherford (1984) report that the matching approach seems to offer an intelligent and practical framework for the organizational problem of dealing with diversity among students.

The concept of individual instruction has become the cornerstone of modern educational practice. Individuation, however, is more than

allowing students to proceed through predefined curriculum at different rates (i.e., mastery learning in the strict sense). Smith and Renzulli (1984) call for the respect of a wider range of the student characteristics that make learners unique. They believe that a well-rounded individualistic effort must take into account how a student would like (preference) to pursue a particular activity. This is in addition to differences in the rate of learning and topic related preferences. Professional associations (i.e., International Reading Association) have called for the recognition of differences in learning styles of children in instructional approaches to meet those differing needs and have even suggested the inclusion of learning style diagnosis in IEPs (Carbo, 1984).

Some research (Smith and Renzulli, 1984) has indicated that harmful effects can result when students and teachers are required to perform over long periods of time in situations that are inconsistent with their style and preferences. Instructional approaches that virtually force students to learn through their style weaknesses tend to produce failure, boredom, and loss of self-esteem, while approaches that capitalize on style strengths tend to increase their self-confidence and achievement (Carbo, 1987a). Stress, frustration and burnout have been attributed to this incongruity. Despite these findings, the typical teachers of today rarely consider learning style preferences in a systematic fashion.

Hart (1986) calls for education that emphasizes the compatibility of instruction with the nature of the brain, not the conventional "brain-antagonistic" classroom teaching. An appropriate educational program for children, Elkind (1988) contends, is one that takes into account their specific modes of learning and provides them with a structured environment (instructional and physical) that promotes successful learning.

Young children, Carbo (1987a) notes, tend to be strongly global in style and thus learn well through holistic methods.

Dunn, Cavanaugh, Eberle and Zenhausern (1982) report that hemispheric processing preferences impacts instruction directly. While right-preference teachers tend to teach deductively, a left-preference teacher tends to teach inductively, a matter which has significant consequences for the learning process (i.e., right and left-preference students). Many poor readers are predominantly global, tactile, and kinesthetic learners which is precisely the reading style accommodated least in U.S. classrooms (Carbo, 1987a). Students spend most of their class time either doing seat work or listening to a teacher lecture. Students are rarely given the opportunity to learn experientially from peer interaction.

In their studies investigating the effects of matching teaching/learning styles, Smith and Renzulli (1984) found that the research could be classified into two general categories, those matching students with teachers (often involving personality factors), and those that match instructional approaches or teaching styles with student learning styles (i.e., instructional responsiveness, accommodation). Dunn and Dunn (1979) caution educators about just matching teachers with students for several reasons. Learning style and teaching style characteristics do not always cluster into neat groups; students and teachers are not, stylistically speaking, consistently one way or the other; matching style alone does not ensure effective teaching; and when taught properly, most teachers can become effective with most students simultaneously. They conclude that it is preferable that teachers be responsive to differences in student learning styles, as opposed to trying to match students with teachers.

Carbo (1987a&b) reports a number of successful pilot programs aimed at improving reading through attention paid to student reading style. She calls for teachers to heed the research on learning and instructional accommodation and give unequal learners an equal chance at becoming successful. If educators focused upon the cognitive processing differences found between males and females, Helfeldt (1983) argues, the result would be more responsive differentiated instructional approaches. In their review of the literature, Smith and Renzulli (1984) and Griggs (1985) reported that when individual learning style preferences are accommodated through complementary teaching styles, instructional approaches and resources, improvement has been demonstrated in academic achievement, student attitudes and student behavior. In an application outside the classroom, Griggs offers a conceptual framework, based on the learning style model, for use within the field of counseling. Brain lateralization and cognitive style have also been related to occupational choice (Schkade & Potvin, 1981).

In numerous studies reported by Dunn (1984), students who were matched with methods, resources or environments that complemented their reported strong preferences achieved statistically higher, while those that were mismatched achieved statistically lower. Dunn finds it reasonable to conclude that since students achieve better when taught through their preferences, their preferences must be their strength. Hartlage and Telzrow (1983) report numerous studies which reveal instructional effectiveness when the neuropsychological strengths of learning disabled students are matched to appropriate teaching strategies.

As Doyle and Rutherford (1984) have noted, teaching is a difficult task undertaken in a complex environment, and learning is also a

demanding task. It is their contention that there is little reason to believe that one dimension of learners, such as style, accounts for achievement differences reported in the literature. While Hartlage and Telzrow (1983) report the literature to be inconclusive with regard to matching learner characteristics with teaching approaches, they suggest that the weaknesses identified in the research resulted from not using a systematic neuropsychological model as the basis for identifying aptitudes and prescribing treatments.

Practitioners are cautioned (Helfeldt, 1983) about applying skills within their classrooms pending more thorough investigation within the classroom itself. While noting there is no definitive teaching approach, Smith and Renzulli (1984) believe it is the teacher who systematically demonstrates a wide range of teaching styles is potentially more capable instructionally than repertoire-limited teachers. Hyman and Rosoff (1984) believe that the learning style paradigm suffers because it omits consideration of subject matter. They feel the nature of the subject matter will exert a controlling influence on the relevant and effective teaching strategies and methods. Warnings against total teaching/ learning matches have also been sounded (Henson and Borthwick, 1984) with the speculation about the overdevelopment of one hemisphere over the other. Despite preferences, an effort should be made to develop both sides of the brain so that they will function synergistically.

Classroom teachers wonder how to translate research into practice. Effective teaching research is the foundation upon which effective schools are based. With an emphasis on the classroom determinants of student achievement, teachers need to discover effective practices. This outcome orientation minimizes the employment of practices that are based solely on

theory. Staff development efforts offer the means to achieve desired instructional improvement goals. Teachers get the research foundation upon which instructional decisions that cause learning are made. When teachers teach more systematically, student achievement improves (Seaburn & Sudlow, 1987).

Most teachers use a very narrow range of practices and few practitioners have mastered specific teaching models (Joyce, Showers & Rolheiser-Bennett, 1987). However, staff development programs can have an impact on the educational practices that affect student learning. Nummela and Rosengren (1986) report positive findings in teacher education efforts that include strategies and methods which acknowledge internal processing as a major aspect of learning. Strong, Silver and Hanson (1985) argue that teachers need to integrate teaching strategies and thinking styles with the elements of effective instruction. With a basis in the principles of learning, teachers learn to monitor and adjust their instructional behavior to meet the needs of their students.

Summary

In summary, research has established an increasingly clear, although not always consistent, relationship between the brain and behavior. While localization of function and hemispheric specialization models have been overly simplistic, they have provided a much needed perspective from which cognitive processing and learning can be viewed. Teachers who possess the theoretical understanding and the practical knowledge regarding cognitive processing preferences are better able to modify and accommodate the instructional process systematically. Teacher education and staff development efforts have proven effective in integrating the

elements of effective instruction, teaching strategies and thinking styles for improved student achievement. The Herrmann four quadrant brain dominance model and instrument help provide individuals with the necessary conceptual framework into which the practical implications of cognitive processing preferences fit.

CHAPTER III
ANTICIPATED OUTCOMES AND EVALUATION INSTRUMENTS

Statement of General Goals

The practicum was a staff development program designed to:

- Promote an increased understanding of how neuroscience research impacts the teaching/learning process;

- promote an increased understanding of how practical applications of cognitive styles research can improve the teaching/learning process;

- help teachers to systematically employ wholebrained and responsive instructional approaches with "at risk" elementary and middle school students;

- and, provide the theoretical/conceptual, practical and experiential knowledge base necessary for subsequent cognitive styles/preferences program development efforts.

Behavioral Expectations

The specific anticipated outcomes for the practicum were as follows:

- Following a series of basic neuroscience and neuroeducational research inservice presentations within identified program schools (See Appendix C for outline), 8 out of 10 of the targeted teachers and support

personnel would, at the 80% level of accuracy, demonstrate their knowledge of the theoretical/conceptual foundation upon which the cognitive styles/preference model is based;

- following inservice training in the Herrmann model, and administration, scoring and personalized interpretation of the HBDI profiles by this writer, 8 out of 10 of the targeted teachers and support personnel would, at the 80% level of accuracy, demonstrate their understanding of their own cognitive style/preference, including the potential implications of their individual style/preference on the teaching and learning process;

- following individual HBDI profile interpretation and instructional implication exercises, 8 out of 10 targeted teachers would demonstrate the integration and practical application of their theoretical/conceptual knowledge by developing responsive instructional methodologies and "wholebrained" teaching/learning approaches for heterogenous groups, as evidenced by the inclusion of 2 or more lesson characteristics under each of Herrmann's 4 quadrants;

- and, 8 out of 10 of the targeted teachers observed would employ appropriate cognitive style/preference responsive and "wholebrained" teaching/learning approaches within the context of their classrooms, as evidenced by the inclusion of 2 or more lesson characteristics under each of Herrmann's 4 quadrants.

Evaluation Instruments

The instrument developed by the writer to evaluate the impact of the basic neuroscience and neuroeducational inservice presentations on program participants was a literature-based, "mixed response" instrument

comprised of three components (See Appendix D). The first was specific to basic neuroscience and was the "fill-in-the-blank" component. Respondents earned 2 points for each correct response within this component. The second component addressed neuroeducational research and was presented in a "True-False" format, with respondents earning 1 point for each correct response. Component three assessed participants' understanding of the Right-Left Hemisphere dichotomy by requesting them to place an "R" or an "L" beside descriptors associated with cerebral dominance and/or processing. For each correct response on this component respondents earned 1/2 point. A total of 100 points could be earned on this instrument (See Appendix E for Scoring Key).

An instrument was also developed by the writer to assess the participants' understanding of their own HBDI profiles, cognitive style/preference, and its implications for the teaching and learning process (See Appendix F). Using a blank HBDI profile, participants "filled-in" basic HBDI information and their Personal Profile Code Numbers. Respondents were then asked to briefly describe, in writing, the significance of the Profile Code Numbers and/or their corresponding terms (Primary, Secondary, Tertiary). Additionally, respondents were asked to briefly describe, again in writing using behavioral descriptions/examples, the implications of their Personal HBDI Profile as it related to their specific teaching/learning style. Respondents earned 2 points for each correctly "filled-in" response (40 points possible), 20 points for correctly describing the Profile Codes, and 40 points for correctly describing their Personal HBDI Profile. Response accuracy was determined on the basis of the individual's HBDI profiles and Herrmann's "Profile Descriptions" (See Appendix G for Scoring Example).

The integration and practical application objective evaluation was undertaken using the Herrmann Four Quadrant Lesson Plan Evaluation Checklist developed by the writer. Participants developed "wholebrain lesson plans" which, when reviewed, were to include a minimum of 2 lesson characteristics per Herrmann quadrant (See Appendix H). Participants earned 10 points for each identified quadrant characteristic. The objective was considered successfully mastered when participants earned 20 points per quadrant.

Observations of randomly selected program participants during a pre-arranged "wholebrain" lesson were conducted by the writer using an adapted version of the Herrmann Four Quadrant Lesson Plan Evaluation Checklist described above (See Appendix I). The observed lesson also needed to include a minimum of two lesson characteristics per Herrmann quadrant if mastery was to be achieved.

As indicated, the 80% mastery level had been set as the standard of achievement for the basic neuroscience and neuroeducational, and individual HBDI profile and interpretation objectives. Integration and practical application objectives involving lesson plans and observations required 2 or more lesson characteristics per Herrmann quadrant in order to achieve mastery. The same individual criterion standards (i.e., 8 out of 10 targeted teachers) had been set for all objectives.

CHAPTER IV
SOLUTION STRATEGY

Discussion and Evaluation of Solutions

Possible solutions to the problem included approaches and strategies from many disciplines. With an organization as large as the writer's public school system, changes of any type were expected to occur gradually, over time. Ideally, prospective teachers would be required to take course work that conveys the functional importance of neuroscience to education. Pre-service education programs with a focus on learning styles would help teachers develop a rationale for their educational practices (Lyons, 1984). This process lays the foundation for the eventual focus on the teaching of the life long skills of learning how to learn. Inservice and staff development programs could, as Joyce et al. (1987) have shown, impact educational practices that affect student learning. Lyons and Languis (1985) emphasized both pre-service and inservice education for teachers focusing on neuroscience research, self-awareness and analysis of learning/teaching patterns and adapting teaching style to learning style/preferences. Whenever educators investigate the teaching/learning process, they should employ a paradigm that encompasses the mental

processes of the learners, their development and their individual processing differences (Wittrock, 1981).

Organizational restructuring could provide the atmosphere or foster an environment where educators regain their professional discretion and responsibility. The legislated learning movement over the last 10 years created an educational environment characterized by standardized testing not educational standards; by teacher-proof curricula, not curriculum reform; by standardized teaching, not professional discretion; and by management-by-the-numbers, not instructional leadership (Wise, 1988). School effectiveness, Kirst (1988) argued, cannot be undertaken in a top-down prescriptive method. School and teacher autonomy allows for individualized approaches to school and student specific needs. Increasing school site responsibility can result in a significant impact in student achievement.

Curriculum development efforts could devote increased attention to the research-driven information base and the "process" of instruction that pays dividends in terms of desired outcomes. When looking at student outcomes, some become preoccupied with special conditions, common characteristics, type of students, etc. With a curriculum that focuses on both quality and equity, a system can transcend these stumbling blocks. Baker (1988) for example, suggested a shift from norm to criterion-referenced tests (CRTs) to allow for the more subtle tuning of curriculum, instruction and ultimately student outcomes. In "Direct Instruction" approaches, knowledge systems, instructional stimuli and behavioral responses were analyzed and structured by curriculum developers (Tarver, 1986). This approach, while effective, is not responsive to the individual learner. This centralized curriculum effort served to undermine the

instructional discretion of the classroom teacher. So, while curriculum reform was beyond the scope of this practicum, a systematic undertaking aimed at improving instructional effectiveness through responsive accommodation was not.

Dunn et al. (1982) found increased student achievement when learning and teaching styles were matched and hemispheric preferences were accommodated instructionally. Carbo (1987a&b) demonstrated that instructional programs can be successful in developing the skills and comprehension of poor readers by accommodating their global reading styles and strengths. She, like others (Nummela & Rosengren, 1986), suggest that educators incorporate research findings regarding internal processing, learning styles and accommodation into effective instructional strategies and methods. An emphasis on "wholebrained" instruction appears most effective with large heterogeneous groups.

Goodlad and Oakes (1988) report that while teachers reject the image of their students as passive learners and are familiar with a variety of teaching modes, research continued to indicate the clear dominance of telling, lecturing, questioning the class and monitoring seat work. It is suggested that educational programs not only recognize, but capitalize upon the different kinds of intelligence and learning styles of students. Numerous research findings as reported by Dunn and Dunn (1987) reveal that the majority of teachers taught "analytically," while many of their students learned best through a "global" style. They found that while students preferring either style achieve, they tended to achieve higher when taught through methods that responded to their individual learning styles.

Reduced class size would likely result in increased individualized instruction as well, but would not result in systematic, research-driven,

responsive instruction. Students who, using traditional methods, would become curriculum casualties, could be given additional support within the classroom. Yet, this instructional support may not be given in a systematic fashion. In accommodating the cognitive style or preference of the learner, teaching methods become more responsive and effective (Carbo, 1987a&b; Dunn et al., 1982; Lyons & Languis, 1985).

Programs that emphasized thinking skills and metacognition held promise for improved student achievement. Vye and Bransford (1981) reported the use of effective school programs designed to help students analyze and evaluate their own problem solving skills. By making the implicit thought processes explicit, students learned about learning and strategic problem solving. These programs were often, in one form or another, a derivation of the CBM programs and procedures. Using the elements of lesson design as a foundation, Strong, Silver and Hanson (1986) offered a model whereby teachers fostered students' thinking skills by choosing appropriate instructional strategies. Teaching strategies were linked with specific curriculum objectives and the type of learner thinking necessary to bring about objective attainment. A different set of relationships was implied with each style. Similarly, "Cognitive Style Mapping" (CSM) involved the diagnosis of a student's relative learning strengths on selected learning variables and the prescription of personalized instruction based on the findings (Cogan, 1976).

Diagnostic evaluations aimed at discerning the cognitive style and/or preferences of all teachers and all students would have yielded vast bodies of relevant information upon which potential instructional decisions could have been based (i.e., lesson design, grouping, team-teacher assignments, pacing). Techniques of potential use in this type of evaluation process

ranged from elaborate and expensive brain mapping techniques to informal observation, depending upon the resources.

Out of his work in the training of corporate managers, Herrmann developed a model for conceptualizing the brain/behavior relationship, particularly as it applies to teaching and learning. The four quadrant brain dominance model has been described by Herrmann as a blending of the hemispheric specialization and triune brain concepts into a physiologically based metaphor of how the brain works (Herrmann, 1986). The model, which had its early beginnings in intuitive observation, has since been shown empirically to have considerable validity. The Herrmann Brain Dominance Instrument (HBDI) provides organized self-report information regarding an individual's cognitive processing preferences and serves to bridge the gap between the theoretical and practical. It is Herrmann's contention, that the teaching/learning process is systematically optimized by applying the model and the information derived from the instrument.

Friedman and Alley (1984) reported a series of steps for implementing a styles project. Initial efforts involved the provision of a series of sessions designed to acquaint the professional staff with the concept of learning styles and teaching/learning applications within the classroom. Subsequently, student style assessment was undertaken to help teachers better understand the various notions they held regarding the individuals and learning groups within their classrooms. However, contrary to popular belief, teachers do not teach the way they were taught, but rather they teach in a manner that is consistent with the way they learn (Dunn and Dunn, 1979). Therefore, researchers (Lyons and Languis, 1984)) suggest that as a prerequisite to understanding the style of others, one must develop an appreciation for his/her own style. This "self-

knowledge" element was viewed by this writer as essential, but was missing from Friedman and Alley's approach, unless it was implicit in the acquainting stage.

A staff development and inservice program, like the one proposed by Lyons and Languis (1985), that emphasizes a basic background in neuroscience research, self-awareness and analysis of learning and teaching patterns and the development of responsive instructional strategies and methods was felt to be optimal, given the scope of the practicum.

Description of Selected Solutions

In his discussion of the educational implications of brain research, Wittrock (1981) concluded that learning was a generative process with the brain being a model builder. Human brains have characteristic processes of functioning, yet vast differences in cognitive processing exist between individuals. Therefore, instructional interventions should be timed to correspond with the growth and development of the brain (Wittrock, 1981). Educators need to make use in schools of what is known holistically about the human brain (Hart,1986).

The practicum solution incorporated Friedman and Alley's (1984) principles of learning/teaching styles. (1) Both the style by which the teacher prefers to teach and the style by which the student prefers to learn can be identified. Teachers are more likely to develop strategies that are congruent with their own learning styles rather than accommodating their students', particularly when unaware of the teaching/learning research. (2) Individuals often assume their way of learning is most effective. Therefore, teachers need to guard against over-teaching in a manner that is unresponsive to the learner. (3) Teachers can become most effective when

they help their students identify and learn through their own style preferences (Phase III). This ultimately provides the foundation for independent and life long learning. (4) Students should have an opportunity to learn through their preferred style. The instructional delivery system should not continue to systematically exclude students from taking advantage of this opportunity. (5) Style preference diversification should be encouraged among both teachers and students. And, (6) specific teaching/learning activities can be developed which reinforce each style. The degree to which teachers are able to develop methods and materials related to styles will largely determine the success of the styles approach.

Using the aforementioned principles as a guide, the practicum process followed a course of development that paralleled the process suggested by Jenkins (In Keefe, 1988, p. 42-43). Orientation and awareness raising sessions provided the foundation for the research-based neuroscience and styles inservice presentations. The development of self-knowledge was fostered through the personal styles profiling experience. Cooperative learning opportunities promoted pilot cohesiveness and collegial support. Continued support was provided through peer and technical coaching, the building administration, and consultation.

The implementation of a "total" styles oriented program would have entailed, in this writer's view, a developmental process involving three distinct phases. The practicum, as the first phase of the three phase process:

- Provided targeted individuals with training in basic neuroscience, which served as the theoretical and conceptual foundation for meaningful interpretation of research related to the teaching/learning process;

- through a styles self-analysis process, promoted an understanding of the practical implications of learning/cognitive styles within the instructional context of the classroom;

- through lesson plan development exercises, helped teachers develop and employ lessons, instructional strategies, approaches, techniques and materials that were more responsive to "at risk" students, specifically, and fostered "wholebrained" processing more generally;

- and, provided the theoretical/conceptual, practical and experiential knowledge base necessary for future cognitive styles/preferences program development involving student profiling and more global integration into the curriculum (Phases II and III).

Future phases of a total styles oriented program, which were beyond the scope of this practicum, would incorporate more formalized student assessment and profiling efforts (Phase II). At that stage, teachers would develop more sophisticated views of their students' learning styles using more objective instrumentation. The final phase in the process would involve the students learning about themselves and their individual styles of learning (Phase III). It is during this final phase that thinking skills, strategic problem solving and metacognitive oriented techniques become integrated into the entire instructional delivery system. Although all three phases can and have been undertaken simultaneously, it was the writer's belief that the developmental process should be undertaken over the course of two or more years. This pacing process would then allow adequate time for individual and institutional assimilation and accommodation.

The selected solution to the practicum problem was multifaceted, and included teacher and support personnel staff development and inservice programming, individual cognitive style/preference profiling, coaching,

"wholebrained" lesson plan development and teaching, and evaluation. The practicum solution process itself attempted to recognize and accommodate the diversity of styles among those participating in the pilot. For example, "wholebrained" instructional techniques were employed during inservice presentations, and evaluation techniques included formal, "mixed" response and informal formats (i.e., paper and pencil tests, group participation, participant response forms, and observations). With its implementation based in research and related professional literature, the proposed solution was expected to succeed in meeting presented objectives. System support was expected because of the relevance of the proposed practicum with "Maximizing Achievement Potential" (MAP) initiatives set forth by the local Board of Education, the Transitional First Grade classrooms, Chapter I team teaching approach (See Appendix K), the superintendent's effective school movement plans and the special education program parameters (See Appendix L), all of which revolved around the concept of understanding the learning differences among students and the meeting of their needs through the instructional process.

By incorporating effective schools methods, the local school system has begun decentralizing the responsibility for "process" and has begun to focus on student "outcomes." This movement has begun to put the responsibility for the "hows" on individual schools and teachers where students needs can be disaggregated and accommodated through responsive accommodation and instruction. As Dunn and Dunn (1987) have indicated, "at risk" students place society at risk. And, unless every child is educated we all stand to suffer. Neuroscience research points the way to make instruction more responsive to students whose needs are not met within the context of a conventional classroom.

To paraphrase Indries Shaw (In Coulson, 1987, November), people have to teach according to the peculiarities of the people who are learning from them. Teachers must have a very versatile and sophisticated type of mind. They can't use a system or a dogmatic approach as ordinarily understood. Instead, a master teacher has a tremendous range of information about how to put the same thing in different ways. Shaw concludes, use them all, all the techniques you know. Similarly, if a teacher has to tell a student the same thing 1000 times and the student still doesn't understand, it's not just the student who hasn't learned.

It was one of the fathers of the effective schools movement, the late Ron Edmonds' contention that educators can, whenever and wherever they choose, successfully teach all children whose schooling is of interest to them. With the current research base, they already know more than they need to do that. Whether or not they do it, Edmonds believed, must finally depend on how they feel about the fact that they haven't so far.

A secondary level learning styles matching program within this writer's system has already met with success. Solorzano (1987) reported that when instructional styles accommodated students' individual needs, test scores rose and student failures dropped. The program was described as personalized teacher-controlled student learning. Similarly, a few of the system's elementary schools have also undertaken projects aimed at implementing teaching/learning models that embrace thinking styles. Preliminary reports indicated that teachers developed an awareness of how their own learning style impacted their teaching, which was then reflected in their more "wholebrained" lessons.

In their study of individual learning styles among prospective elementary teachers, Lyons and Languis (Undated) concluded that within

the cognitive style models, it is individual differences rather than group differences, that are more valuable for designing instructional strategies, especially as they relate to cognitive processes and structures. Therefore, it is the process-oriented individual differences which hold promise for the practical application of a learner's cognitive style to teaching. Lyons and Languis (1984) contend however, it is only when teachers come to understand themselves as learners that they are in a position to help students learn.

As Sylwester (1981) has pointed out, it is a rare educator who has a respectable background in neuroscience; and it is a rare inservice program that systematically introduces relevant brain research to its teaching and support staff. Neuroscience provided the theoretical and conceptual foundation upon which the practicum solution was based. In cooperation with building administrators, the targeted teachers and the appropriate support personnel were to be identified in each of the five elementary and two middle schools. In a series of staff development and inservice presentations throughout the first term of the 1988/89 school year, participants were to develop a basic understanding of the relevant neuroscience concepts and research findings. During the series of presentations, Herrmann's 4 quadrant brain dominance model was focused upon specifically, because it served as the perspective from which the individual cognitive style/preference profiles were viewed.

The writer had been trained in the appropriate use of the HBDI by the instrument's developer (See Appendix M). The HBDI was to be administered to targeted personnel (teachers and support personnel), the instruments were then scored and profiles were generated. Individuals who completed the HBDI were provided with a cognitive style/preference

profile upon which he/she were to base his/her self-analyses. HBDI profiles were personally interpreted by the writer within the context of the inservice presentations. Opportunities for individualized attention was assured through cooperative learning experiences, peer coaching and the consultative services provided by the writer.

Using their personal cognitive style/preference profiles, teachers, aided by support personnel (i.e., teacher specialists, psychologists) and this writer, were to develop an understanding of how their style influenced their instructional approach. After all, even with a foundation of meaningful research-based knowledge, teachers require assistance in the process of practical translation (Friedman and Alley, 1984). Alternative instructional strategies and methodologies were to be explored and "wholebrained" lesson plans developed and evaluated. Observations were to be conducted and were to serve as documentation of the transfer of training (practical application) from inservice presentations and exercises to the classroom. Teachers also were to be offered overview training in the determination of student cognitive style/preference using already available information (i.e., profiling process using psychological evaluation data, standardized test results and observational data).

Following the series of inservice and profiling experiences, teachers were to have the opportunity to implement the model within their classrooms for a minimum of one academic term, during which time randomly selected teachers were to be observed. The translating of the awareness of style differences into strategies within the classroom is not easily undertaken (Bargar and Hoover, 1984). The process of applying knowledge and skills (i.e., transfer of training) within the classroom was to be accomplished through "technical" coaching. The writer, and

appropriate support personnel, were to provide technical coaching and consultative services as needed. This approach was utilized to foster a common language, collegiality, increased professional dialogue, and a longer and more appropriate use of knowledge and skills (Garmston, 1987). Targeted teachers were to be encouraged to engage in "challenge" or problem solving peer coaching activities. When confronted with a persistent problem, teachers could have used this type of coaching to promote instructional improvements that were consistent with the model employed (Garmston, 1987).

The theoretical/conceptual inservice education effort was to be evaluated at various levels (i.e., theoretical and conceptual specific objective evaluation instruments), as was the practical application of the inservice education and profiling efforts (i.e., profiling assessment, and lesson plan evaluation techniques). Finally, observations were to be conducted in randomly-selected targeted teachers' classrooms. These results were to be used to determine the practical translation of formative education exercises into "wholebrained" instructional approaches employed by the teachers within their respective classrooms.

Report of Action Taken

The practicum process, like many processes that occur over an extended period of time, was influenced and impacted by many factors. While many of these were anticipated, several were unexpected and necessitated adjustments in design and implementation. Organizational factors were among the most influential. As noted previously, the addition of an area-based psychologist resulted in school reassignment and the

breaking of the "feeder pattern" initially targeted during the practicum proposal stage.

Even within the reconstituted assignment of schools, it was the school system's complete commitment to the Effective Schools process that altered the course of practicum planning and execution. Many of the schools targeted in the practicum proposal had, in an effort to comply with mandates from the superintendent's office, already committed their individual resources (i.e., personnel, time, monies) to Effective Schools related endeavors (i.e., staff development, release and meeting time, etc.). This meant that the writer needed to solicit the approval and cooperation of administrative and school-based personnel beyond the bounds of his normal school assignment (i.e., feeder pattern). Fortunately, administrative approval was readily attained and, following a brief solicitation effort, four elementary schools expressed an interest in the practicum concept. One of the schools was among those already assigned to the writer, while the other three were not. In fact, two of the schools were from the school system's other administrative area.

The issues surrounding resource limitations within the newly constituted targeted population were eventually addressed through grant monies. Each of the school's administrative staff coordinated efforts with one of the other schools and with the writer in an effort to produce grant proposals aimed at implementing the practicum as described. The grant proposals were submitted to the Supervisor of Staff Development, approved, and fully funded through pooled local and state resources. While the specifics of each grant varied slightly, each cooperating school pair received two full days out of the academic calendar during which schools were closed to students and the staff participated in the staff

development presentations and activities. Additionally, funds from the grants were used to provide participants with lunch and program materials, to secure substitute pay for the teaching personnel used during the presentations, to purchase the HBDI profile scoring service offered through The Ned Herrmann Group, and for each school to begin collecting school-based resource materials relevant to teaching/learning processes and learning/cognitive styles (i.e., books, periodicals, etc.).

The staff development programs differed between the two school pairs with respect to the time allocated to each of the presentation's subcomponents. While both groups allotted one half day for HBDI profile interpretation, one group chose to spend one entire day on the theoretical/conceptual presentation. The other group opted to spend an entire day on the practical application presentation which was offered to help generalize research findings into instructional practices within the classroom. The writer was the presenter for the basic neuroscience and neuroeducational research, and HBDI profile interpretation portions of the staff development programs. While the writer was involved in all facets of the individual programs, the specific instructional application presentations were conducted by the system's Curriculum Specialist for Elementary Language Arts and three selected teachers who were thoroughly familiar with the cognitive styles model, wholebrained instruction and had been recognized as "master" teachers.

The writer and the other presenters attempted to employ presentational (instructional) methods that were consistent with the proposed "wholebrained" model. Program overviews were given orally and on paper in the form of a handout (See Appendix C). Objectives, and the process for evaluation, were discussed. Actual presentations

incorporated lecture, dramatic modeling, group participation and individual and small group activities. Oral presentations were always supplemented with visuals (i.e., overheads, models, sample items, video and film) and were structured loosely enough to accommodate individual and group questions and interests. Additionally, music was used during individual work periods and breaks.

The practicum as initially proposed was to focus its efforts upon the teachers of "at risk" students particularly. Adjustments made as a result of Effective Schools mandates and the staff development grants, while including the teachers of "at risk" students in the four elementary schools, included a larger more generalized population of teachers. Participant parameters were also influenced by other factors as well. Program participation was mandatory. Because participation in the programs was not voluntary as initially proposed, the level of compliance (i.e., completion of evaluation instruments, participation in lesson development) varied significantly from that expected in the proposed practicum.

The writer capitalized upon the nature of the school groups (i.e., working bodies comprised of cooperative teams and individuals) and, in addition to generating individual HBDI profiles, provided each individual with team (i.e., third grade teachers, specials teachers, administrative and support personnel) and school profiles (See Appendix N). These composite profiles were employed to assist the teachers in better understanding individual team members, team processes and group problem solving.

Throughout the practicum process the writer served as consultant to individual program participants, school-based teams and administrators. In addition to personal interaction with these individuals and groups, the writer developed and provided each school with a resource guide which

included printed materials related to the entire staff development program (i.e., literature review conducted by the writer, reference list, extensive bibliography, HBDI profile interpretation information, and visual depictions of the teaching/learning styles model, See Appendix O). Journal articles and books used by the writer during the literature review, were made available to participants upon request.

CHAPTER V

RESULTS, CONCLUSIONS AND RECOMMENDATIONS

Results

The practicum outcome was positive. The entire instructional faculties of 4 elementary schools and various support personnel, totaling more than 70 educators, participated in the practicum's programs. As a result, the staff development programs successfully; promoted an increased understanding of how neuroscience research impacts the teaching/learning process; promoted an increased understanding of how practical applications of cognitive styles research could improve the teaching/learning process; helped teachers to systematically employ wholebrain and responsive instructional approaches with elementary students; and, provided the theoretical/conceptual, practical and experiential knowledge base necessary for subsequent cognitive styles/preferences program development efforts.

It should be noted, however, that in the "Statement of General Goals" in Chapter III, elementary and middle school teachers of "at risk" students were initially targeted. Circumstances (See Report of Action Taken, Chapter IV) necessitated a course of action which excluded middle school teachers, and included the full teaching staffs of four elementary schools,

not merely the teachers of "at risk" students. Although the practicum was considered a success, one of the stated objectives was not fully realized.

Although more than 70 educators participated in the programs, noncompliance with evaluative efforts (i.e., Basic Neuroscience and Neuroeducational Research and Individual HBDI Profile Evaluation Instruments and "wholebrained" lesson plan development exercises) resulted in the collection of data from between 59 (Basic Neuroscience Instrument) and 22 (lesson plans) participants. Participant outcomes relative to specific practicum objectives are reported below. In order to facilitate interpretation of outcomes relative to objectives, representational averages have been represented graphically in Figure 1.

Following the series of basic neuroscience and neuroeducational research staff development presentations, 42 out of 59 (representational average of 7.1/10) of the targeted teachers and support personnel completing the evaluative instrument demonstrated their knowledge of the theoretical/conceptual information, at the 80% level of accuracy, upon which the cognitive styles/preference model was based. The criterion standard of "8 out of 10 of the targeted teachers and support personnel" had been set for this objective and was not realized. An analysis and speculation as to the reason for nonattainment of this objective will follow.

Following the staff development training in the Herrmann model, and the personalized interpretation of HBDI profiles, 47 out of 52 (9.1/10) of the targeted teachers and support personnel completing the evaluation instrument, at the 80% level of accuracy, demonstrated their understanding of their own cognitive style/preference, to include the potential implications of their individual style/preference on the teaching and

learning process. Targeted individuals exceeded the criterion standard of "8 out of 10" and surpassed the expectations set forth in the objective.

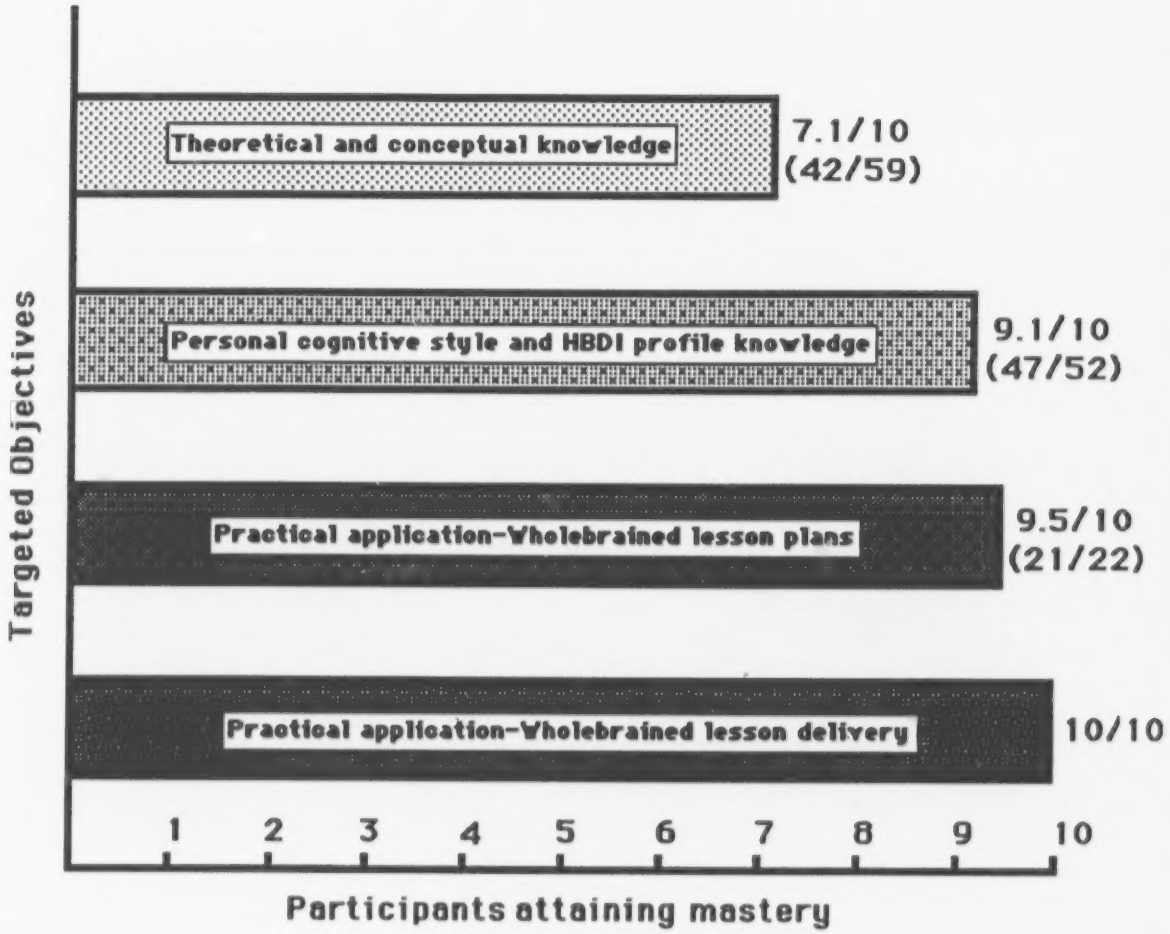


Figure 1. Summary of Objective Evaluation Results

Following HBDI profile interpretation and instructional implication exercises, 21 out of 22 (9.5/10) of the targeted teachers who developed lesson plans demonstrated their integration and practical application of

their theoretical/conceptual knowledge by including in their plans, responsive instructional methodologies and "wholebrained" teaching/learning approaches. Criterion standards were again exceeded. All teachers participating in the lesson plan development component successfully included a minimum of 2 lesson characteristics per Herrmann quadrant (mastery) within their "wholebrained" lesson plans.

Observations revealed that 10 out of 10 of the targeted teachers employed appropriate cognitive style/preference responsive and "wholebrained" teaching/learning approaches within the context of their classrooms. All prearranged lesson observations within the classrooms of 10 randomly selected program participants, revealed a minimum of 2 lesson characteristics per Herrmann quadrant, thus demonstrating mastery, and again surpassing the criterion standard.

Conclusions

The practicum effectively integrated theoretical/conceptual components found within the literature with research findings to provide a rather comprehensive program. As Wittrock (1981) stated, human brains have characteristic processes of functioning, with vast differences in cognitive processing existing between individuals. It is the duty of educators to make use in schools of what is known holistically about the human brain (Hart, 1986). In training and implementation of educational programs, however, the impact of neuropsychological research have, for the most part, been overlooked Kinberg, 1983). It is a rare educator, Sylwester (1981) suggests, who has a respectable background in neuroscience; and it is a rare staff development program that systematically introduces relevant brain research to its teaching and support staff.

Without appropriate conceptual knowledge, educators fail to systematically accommodate and adjust their instruction (Lyons and Languis, 1986). Throughout the practicum process, knowledge about the brain and its functioning was shared with educators from a variety of perspectives (i.e., theoretical/conceptual, personal, practical) in an effort to affect change in the instructional "trenches." Evaluation results indicated that teachers were capable of translating their theoretical/conceptual and personal knowledge into practical "wholebrained" instructional methods and approaches.

The basic neuroscience and neuroeducational research presentations served to raise awareness, provided a common language and provided a theoretical/conceptual framework from which to interpret teaching/learning research and instructional practices. While the research (Lyons and Languis, 1985 and Kinberg, 1983) suggests that this is a weak link in the applied styles process, it may be the most difficult to change, at least in isolation, within the context of inservice education. Solid foundations, conceptual or otherwise, are carefully planned and constructed over time, not brought about in a "one shot" effort. The practicum attempted to set in motion the conceptual foundation planning and building processes necessary to effect long term change.

Objective nonattainment in this area (theoretical/conceptual) was likely the result of the complexity of the task undertaken and the nature of the objective evaluation instrument. The instrument developed and used to evaluate the basic neuroscience and neuroeducational research objective, was content specific and time consuming to complete. The examination of another instrument, the Participant Response Form (See Appendix P) used by the writer to help improve presentations, provided data relative to subjective experiences and outcomes. Participant response information

(Table 3, ratings on question 4; and Appendix Q) indicated that many found the instrument too specific and too difficult to complete. Like other aspects of objective evaluation within the practicum undertaking (i.e., lesson planning particularly), the instruments were simply constructed and demonstrated face validity only. Interestingly, while the practicum's objective for this (theoretical/conceptual) component was not attained, as evidenced on the formal evaluation instrument, participants overwhelmingly rated the component as successfully accomplishing its listed objectives (Table 3, ratings on question 3). Assessment practices, like the processes of planning and building a sound conceptual foundation, should be systematically undertaken over time, using a variety of sampling methods.

Table 3

Summary of 59 Participant Response Forms Rating Basic Neuroscience, Neuroeducational Research and HBDI Presentations

This Workshop:	Strongly Agree	Agree Somewhat	Undecided	Disagree Somewhat	Strongly Disagree
1. was just what I expected ..	9	29	6	13	2
2. required active participant involvement	3	28	2	23	3
3. accomplished its listed objectives very well	19	28	10	1	1
4. required a reasonable amount of homework for me	4	7	5	19	21

5. would be of great value to others in my building ...	4	22	7	12	2
6. was a stimulating experience.....	14	30	4	9	2
7. was practical	4	31	9	11	4
8. should be offered again next year	4	22	17	10	6
9. will help me in my job	5	36	5	11	2

10. My overall evaluation is:

Outstanding	Very Good	Satisfactory	Marginally Satisfactory	Unsatisfactory
5	15	18	7	1

The utilization of the Herrmann's Brain Dominance Model and the HBDI profiling, effectively served to bridge the theoretical/conceptual and the practical/personal knowledge gap. The simplicity and integrity of the four quadrant model facilitated application to the teaching/learning process. A positive outcome on this self-knowledge objective was critical to the practicum's overall success. Lyons and Languis (1984) clearly reported self-knowledge with regard to style as a necessary prerequisite to the identification and appreciation of the styles of others. Providing the participants with relevant team and school profiles offered opportunities for styles related insights beyond the classroom and the targeted teacher/student relationships. While no formal objectives or evaluation was undertaken in this area, informal observations and reports indicated that collegial support, cooperative learning and peer coaching were facilitated through this sharing experience.

The practical application of one's styles related knowledge, in the form of lesson planning and delivery, may be considered the fruit of the practicum's efforts. Research has indicated that teachers teach the way they learn (Dunn and Dunn, 1979), often teach using an analytical style when their students learned best using a global style (Carbo, 1987a; Dunn and Dunn, 1987), and utilize a very narrow range of instructional practices (Joyce, Showers and Rolheiser-Bennett, 1987). Therefore, it was pleasing to observe teachers breaking the "stereotypic mold" by developing and implementing "wholebrained" lessons which minimized the systematic exclusion of students. Because many factors contribute to putting students "at risk" educationally, it was gratifying to help teachers explore the options that offered a solution to the problem.

While teachers have always been aware of the need to adapt their instructional methods to accommodate learner characteristics, it has been the learning styles model which has provided the foundation from which systematic adjustments could be made (Smith and Renzulli, 1984). As Henson and Borthwick (1984) indicate, it is the examination of learning/cognitive styles that provides today's teachers with the framework for the systematic development of more personalized forms of instruction. After all, when teachers teach more systematically, student achievement improves (Seaburn and Sudlow, 1987). A complex myriad of factors contribute to putting children "at risk" outside their educational environments. As an individual school system and as a nation, we can no longer minimize the human and social price we pay for putting our children "at risk" educationally. In a small but significant way, this "theory into practice" practicum undertaking, and the subsequent processes to follow, will have made a responsible contribution to the solution of this

problem. The writer believes, as Ron Edmonds stated, we can, whenever and wherever we choose, successfully teach all children whose schooling is of interest to us.

Unanticipated outcomes of an promising nature have already brought about a more far reaching integration of learning/cognitive styles staff development and programming. In an effort to expose building level administrators to models for consideration for school specific staff development programming, the Area Superintendents for Effective Schools capitalized upon the writer's experiences and expertise. The principals, and in some instances other school administrators, of every school within the writer's system (45 in total), had the opportunity to complete the HBDI from which a personal profile was then generated. Agenda time was obtained during the regularly scheduled Administrative and Supervisory Meetings at which time the writer presented an overview of learning/cognitive styles research and interpreted their individual HBDI profiles. As a result of these opportunities, the writer has been consulted regarding cognitive style staff development programs in seven additional schools, and has already agreed to conduct an inservice program for the entire staff of an elementary school prior to year's end.

Similar model review and profiling efforts were undertaken with area-based support personnel and the staff of the Student Services Division. While many of the individuals within this group provide support outside the context of the classroom and had no "specific" need for knowledge regarding instructional application, they used their style and profile information to better understand the dynamics of group processes (i.e., team building, problem solving).

A cognitive styles presentation was also given by this writer during the local Council for Exceptional Children's (CEC) Fall program.

In summary, the results of the practicum indicated that teachers developed the theoretical/conceptual and personal knowledge of learning/cognitive styles necessary to understand its relationship to the teaching/learning process. Teachers then successfully applied their knowledge during practical exercises involving lesson planning and delivery.

Recommendations

If similar staff development efforts are to be undertaken in other contexts, schools or otherwise, it is recommended that the theoretical/conceptual component be carefully tailored (i.e., cognitive styles responsive) to meet the specific "needs" and "interests" of the participants. Brief within-context exposures, over the course of a longer period of time, would likely yield more meaningful and longer lasting results. The nature of voluntary participants, as a self-selecting population, would also increase the likelihood of positive outcomes. Regardless, effective understanding and change will take time.

With a solid theoretical/conceptual foundation and insights into ones own teaching/learning style, recommendations are made for consideration of Phases II and III. As previously discussed, Phase II would involve more formalized student assessment and profiling efforts. Instruments and techniques for determining student learning/cognitive styles would be explored fully. Knowledge of student style would then lead to student-specific responsive instruction. Teachers would then, as Strong, Silver and Hanson (1985) suggest, be able to integrate their style responsive

instructional strategies with the elements of effective instruction. During Phase III it is recommended that students become acquainted with styles related concepts and language. And in addition to the metacognitive component of Phase III, styles oriented methods and strategies would become an integral part of the entire curriculum (i.e., thinking skills, strategic problem solving). This three phase process would allow for the full assimilation of the styles oriented contribution to education.

It is important to note here, that the staff development efforts undertaken within this practicum, and proposed in future phases, make no specific mention of student outcomes. While purposely developed in this manner to meet the needs of the practicum project, educational undertakings of this proportion need to assess student impact. Fortunately, school systems like that of the writer's, have a system for monitoring and disaggregating a variety of student outcomes (i.e., achievement, special education placements) that makes the "bottom line" effectiveness of such undertakings explicit.

If positive student outcomes can be consistently attributed to cognitive style programs and "wholebrained" instructional methods and strategies, then teacher preparation programs (preservice) need to investigate how they can better integrate relevant research and application training components.

Dissemination

The writer will continue to serve as a consultant to individual schools already implementing learning/cognitive style programs and those schools interested in exploring and/or implementing similar programs. Discussion has taken place regarding the possible inclusion of a cognitive styles review

and HBDI profiling experience in the "new teacher induction" process undertaken by the system prior to the start of the new school year. Departmentally, Special Education and Chapter I offices have expressed an interest in similar staff development efforts.

Conference presentation opportunities will be sought by the writer at local, state and national levels. Abstracts will be forwarded to the editors of selected newsletters and journals for consideration of publication. A practicum report will also be sent to ERIC to be considered for inclusion in the appropriate informational clearinghouse.

REFERENCES

Adams, M. J. & Yeargin-Alsopp, M. (1987). Assessment of the number and characteristics of persons affected by learning disabilities. In Interagency Committee on Learning Disabilities, Learning Disabilities: A Report to the U. S. Congress. The Secretary of Health and Human Services, Washington, D. C.

Baker, E. L. (1988). Can we fairly measure the quality of education? NEA Today, 6, 9-14.

Bargar, R. R. & Hoover, R. L. (1984). Psychological type and the matching of cognitive styles. Theory into Practice, 23, 56-63.

Bireley, M. & Hoehn, L. (1987). Teaching implications of learning styles. Academic Therapy, 22:4, 437-441.

Board of Education of Frederick County, Department of Compensatory and Accountability Services (1986). A report of student participation and achievement: An educational equity report. Frederick, MD: Author.

Board of Education of Frederick County, Department of Compensatory and Accountability Services (1987). Frederick County Public Schools 1987-1988 Fact Sheet. Frederick, MD: Author.

Board of Education of Frederick County (1987). A map to excellence: Maximizing achievement potential toward excellence. Frederick, MD: Author.

Brophy, J. (1986). Teacher influences on student achievement. American Psychologist, 41, 1069-1077.

Carbo, M. (1984). Research in learning style and reading: Implications for instruction. Theory into Practice, 23, 72-76.

Carbo, M. (1987a). Deprogramming reading failure: Giving unequal learners an equal chance. Kappan, 69, 197-202.

Carbo, M. (1987b). Matching reading styles: Correcting ineffective instruction. Educational Leadership, 45, 55-62.

Cermak, L. S. (1983). Information processing deficits in children with learning disabilities. Journal of Learning Disabilities, 16, 599-605.

Chall, J. S. (1981). Educational implication of recent brain research. Educational Leadership, 39, 11.

Cherkes, M. (1983). Cognitive development and cognitive style. Journal of Learning Disabilities, 16, 95-101.

Cogan, M. (1976). Cognitive style mapping: A system for planning true personalized instruction. St. Louis, MO: National Association of Teacher Educators Conference. (ERIC Document Reproduction Service No. ED 121 745).

Coulson, T. (1987, December). An introduction to brain dominance research. Consultant to Frederick County Public Schools. Applied Creative Learning Systems, Seminole, FL.

Coulson, T. & Strickland, A. (1987, November). Using individual differences to promote professional effectiveness. In Regional Education Service Agency, Region Staff Development Council Institute, Hagerstown, Maryland.

Das, J. P. (1984). Simultaneous and successive processing in children with reading disability. Topic in Language Disorders, 4, 34-47.

Davis, B. J. & Quick, L. (1981). Making IEPs work in the regular classroom. Academic Therapy, 17:2, 239-243.

Dean, R. S. (1984). Functional lateralization of the brain. Journal of Special Education, 18, 239-255.

deBettencourt, L. U. (1987). Strategy training: A need for clarification. Exceptional Children, 54, 24-30.

Doyle, W. & Rutherford, B. (1984). Classroom research on matching learning and teaching styles. Theory into Practice, 23, 21-25.

Dunn, K. & Dunn, R. (1987). Dispelling outmoded beliefs about student learning. Educational Leadership, 44, 55-62.

Dunn, R. (1984). Learning style: State of the science. Theory into Practice, 23, 10-19.

Dunn, R., Cavanaugh, D. P., Eberle, B. M. & Zenhausern, R. (1982). Hemispheric preference: The newest element of learning style. The American Biology Teacher, 44, 291-294.

Dunn, R. S. & Dunn, K. J. (1979). Learning styles/teaching styles: Should they... Can they... Be matched? Educational Leadership, January, 238-244.

Edmonds, R. R. (1979). Some schools work and more can. Social Policy, March/April, 42-46.

Elkind, D. (1988). Educating the very young: A call for clear thinking. NEA Today, 6, 22-27.

Fairweather, Hugh (1976). Sex differences in cognition. Cognition, 4, 231-280.

Fischer, K. W. & Lazerson, A. (1984). Human development from conception through adolescence. New York: Freeman.

Friedman, P. & Alley, R. (1984). Learning/teaching styles: Applying the principles. Theory into Practice, 23, 77-81.

Fuller, J. K. & Glendening, J. G. (1985). The neuroeducator: Professional of the future. Theory Into Practice, 24, 135-137.

Gaddes, W. H. (1980). Learning disabilities and brain function: A neuropsychological approach. (2nd ed.) New York: Springer-Verlag.

Garmston, R. J. (1987). How administrators support peer coaching. Educational Leadership, 44, 18-26.

Goodlad, J. I. & Oakes, J. (1987). We must offer equal access to knowledge. Educational Leadership, 45, 16-22.

Gregorc, A. F. & Butler, K. A. (1983). Learning/teaching style: A status report. NASSP's Curriculum Report, 12, 1-6.

Griggs, S. A. (1985). Counseling for individual learning styles. Journal of Counseling and Development, 64, 202-205.

Hart, L. A. (1981). Educational implication of recent brain research. Educational Leadership, 39, 17.

Hart, L. A. (1986). A response: All "thinking" paths lead to the brain. Educational Leadership, 43, 45-48.

Hartlage, L. C. & Telzrow, C. F. (1983). The neuropsychological basis of educational intervention. Journal of Learning Disabilities, 16, 521-528.

Helfeldt, J. P. (1983). Sex-linked characteristics of brain functioning: Why Jimmy reads differently. Reading World, 22, 190-196.

Henson, K. T. & Borthwick, P. (1984). Matching styles: A historical look. Theory into Practice, 23, 3-9.

Herrmann, N. (1984). Herrmann Participant Survey Form. Lake Lure, NC: Applied Creative Services, Ltd., Quadra, Inc.

Herrmann, N. (1986). The application of brain dominance technology to the training profession. Lake Lure, N. C.: Applied Creative Services, Ltd.

Hiscock, M. & Kinsbourne, M. (1987). Specialization of the cerebral hemispheres: Implications for learning. Journal of Learning Disabilities, 20, 130-143.

Hopkins, R. L. (1984). Educating the right brain: Why we need to teach patterning. The Clearing House, 58, 132-134.

Hyman, R. & Rosoff, B. (1984). Matching learning and teaching styles: The jug and what's in it. Theory into Practice, 23, 35-43.

James, U. (Undated). The Herrmann, Myers-Briggs Connection. Alexandria, VA: Congruent Systems.

John, E. R., Prichep, L. S., Fridman, J. & Easton, P. (1988). Neurometrics: Computer-assisted differential diagnosis of brain dysfunctions. Science, 239, 162-169.

Johnson, D. J. (1987). Nonverbal learning disabilities. Pediatric Annals, 2, 133.

Joyce, B., Showers, B. & Rolheiser-Bennett, C. (1987). Staff development and student learning: A synthesis of research on models of teaching. Educational Leadership, 45, 11-23.

Kane, M. (1984). Cognitive styles of thinking and learning: Part one. Academic Therapy, 19:5, 527-536.

Keefe, J. W. (1985). Assessment of learning style variables: The NASSP task force model. Theory Into Practice, 2, 138-144.

Keefe, J. W. (Ed.). (1988). Profiling and utilizing learning style. Reston, VA: National Association of Secondary School Principals.

Keefe, J. W. & Monk, J. S. (1986). Learning Style Profile Examiner's Manual. Reston, VA: National Association of Secondary School Principals.

Kinberg, G. (1983). Brain activity and learning. Reading Improvement, 20, 176-180.

Kirst, M. W. (1988). Who should control our schools? National Education Association, January, 74-79.

Kolligiam, J. & Sternberg, R. J. (1987). Intelligence, information processing, and specific learning disabilities: A triarchic synthesis. Journal of Learning Disabilities, 20, 8-16.

League of Women Voters of Frederick County, Inc. (1986). Know your county. Frederick, MD: Author.

Levin, J. R. (1986). Four cognitive principles of learning-strategy instruction. Educational Psychologist, 21, 3-17.

Luria, A. R. (1973). The working brain: An introduction to neuropsychology. (B. Haigh Trans.) New York: Basic Books.

Lyons, C. A. (1984). The relationship between prospective teachers' learning preference/style and teaching preference/style. (ERIC Document Reproduction Service No. ED 243 838).

Lyons, C. A. & Languis, M. L. (Undated). Learning processes in prospective elementary teachers: Examination of a model. Unpublished manuscript, The Ohio State University.

Lyons, C. A. & Languis, M. L. (1984). Understanding your own learning processes can improve your teaching. Manuscript submitted for publication.

Lyons, C. A. & Languis, M. L. (1985). Cognitive science and teacher education. Theory into Practice, 2, 127-130.

Mamchur, C. (1984). Don't let the moon break your heart. Educational Leadership, February, 77-79.

Meyers, M. J. (1987). Information processing and the slingerland screening tests. Journal of Learning Disabilities, 16, 150-153.

National Association of Secondary School Principals (1982). Student learning styles and brain behavior. Reston, VA: Author.

Nickerson, R. S. (1981). Thoughts on teaching thinking. Educational Leadership, 39, 21-24.

Nummela, R. M. & Rosengren, T. M. (1986). What's happening in students' brains may redefine teaching. Educational Leadership, 43, 49-53.

Obrzut, J. E. (1981). Neuropsychological assessment in the schools. School Psychology Review, 3, 331-342.

Obrzut, J. E. & Hynd, G. W. (1983). The neurobiological and neuropsychological foundations of learning disabilities. Journal of Learning Disabilities, 16, 515-520.

Oldenburg, D. (1987, Sept. 1). A different kind of learning. The Washington Post, p.C5.

Petreshene, S. (1982). Three children: three modes of learning. Instructor, March, 50-54.

Rennels, M. R. (1976). Cerebral symmetry: An urgent concern for education. Phi Delta Kappan, 57, 471-472.

Restak, R. M. (1986, April 20). Why some children don't learn: Scientists look for answers within the brain. The Washington Post, pp. 1,11-13.

Reynolds, C. R., Kaltsounis, B. & Torrance, E. P. (1979). A children's form of your style of learning and thinking: Preliminary norms and technical data. The Gifted Child Quarterly, 4, 757-767.

Samuels, S. J. (1987). Information processing abilities and reading. Journal of Learning Disabilities, 20, 18-22.

Samuels, S. J. (1987). Why it is difficult to characterize the underlying cognitive deficits in special education populations. Exceptional Children, 54, 60-62.

Schkade, L. L. & Potvin, A. R. (1981). Cognitive style, EEG waveforms and brain levels. Human Systems Management, 2, 329-331.

Seaburn, B. & Sudlow, R. (1987). Staff development implications of an effective schools project. Unpublished manuscript. Spencerport Central Schools, Spencerport, NY.

Smith, L. H. & Renzulli, J. S. (1984). Learning style preferences: A practical approach for classroom teachers. Theory into Practice, 23, 44-50.

Solorzano, L. (1987, Aug, 31). Helping kids learn-their own way. U. S. News & World Report, p62.

Springer, S. P. & Deutsch, G. (1981). Left brain, right brain. New York: W. H. Freeman.

Sternberg, R. J. (1981). Intelligence as thinking and learning skills. Educational Leadership, 39, 18-20.

Stevens, L. J. (1987, March). Cognition and metacognition: Teaching and learning strategies for mildly handicapped students. Pennsylvania Resource and Information Center for Special Education Newsletter, p. 1-3.

Strong, R. W., Silver, H. F. & Hanson, R. (1985). Integrating teaching strategies and thinking styles with the elements of effective instruction. Educational Leadership, 42, 9-15.

Swanson, H. L. (1987a). Information processing theory and learning disabilities: An overview. Journal of Learning Disabilities, 20, 3-7.

Swanson, H. L. (1987b). Information processing theory and learning disabilities: A commentary and future perspective. Journal of Learning Disabilities, 20, 155-166.

Sylwester, R. (1981). Educational implication of recent brain research. Educational Leadership, 39, 6-10.

Sylwester, R. (1982a). A child's brain: Part I. Instructor, 92 (2), 89-93.

Sylwester, R. (1982b). A child's brain: Part II. Instructor, 92 (3), 64-67.

Tarver, S. G. (1986). Cognitive behavior modification, direct instruction and holistic approaches to the education of students with learning disabilities. Journal of Learning Disabilities, 16, 368-375.

Telzrow, C. F. & Speer, B. (1986). Learning-disabled children: General suggestions for maximizing instruction. Techniques: A Journal for Remedial Education and Counseling, 2, 341-352.

Torres, C. & Katz, J. H. (1983). Neuro-linguistics programming: Developing effective communication in the classroom. Teacher Educator, 19 , 25-32.

Turner, D. (1987, January 15). Brain mapping: Technology provides a major new diagnostic tool. The Columbia Flier, p. 32.

Vye, N. J. & Bransford, J. D. (1981). Programs for teaching thinking. Educational Leadership, 39, 26-28

Webb, G. M. (1983). Left/right brains, teammates in learning. Exceptional Children, 49, 508-515.

Wiens, J. W. (1983). Metacognition and the adolescent passive learner. Journal of Learning Disabilities, 16, 144-149.

Wise, A. E. (1988). The two conflicting trends in school reform: Legislated learning revisited. Kappan, 69, 328-333.

Wittrock, M. C. (1981). Educational implication of recent brain research. Educational Leadership, 39, 12-15.

Wittrock, M. C. (1985). Teaching learners generative strategies for enhancing reading comprehension. Theory Into Practice, 24, 123-126.

Wong, B. Y. (1986). Metacognition and special eduction: A review of a view. Journal of Special Education, 1, 9-29.

Yellin, D. (1983). Left brain, right brain, super brain: The holistic model. Reading World, 23, 36-44.

APPENDICES

APPENDIX A

DESCRIPTORS ASSOCIATED WITH LEFT-HEMISPHERE DOMINANCE AND PROCESSING

DESCRIPTORS ASSOCIATED WITH LEFT-HEMISPHERE DOMINANCE AND PROCESSING

Verbal
Logical
Analytic
Intellectual
Rational
Dominant
Worldly

Mathematical
Quantitative
Numerical
Abstract Symbolic

Convergent
Linear
Sequential
Successive
Temporal
Following

Critical
Controlled
Conservative
Administrative
Organizing
Ordering
Detailed

Focal
Technical
Factual
Precise
Verifying
Differentiating
Judgmental

Reading
Writing
Naming

APPENDIX B

DESCRIPTORS ASSOCIATED WITH RIGHT-HEMISPHERE DOMINANCE AND PROCESSING

DESCRIPTORS ASSOCIATED WITH RIGHT-HEMISPHERE DOMINANCE AND PROCESSING

Nonverbal
Spatial
Relational
Metaphoric
Minor

Synthesizer
Gestalt
Holistic
Global
Integrative

Artistic
Creative Innovative
Musical

Approximator
Simultaneous Parallel
Model Builder

Emotional
Intuitive
Receptive
Spiritual

Experimental
Divergent
Diffuse
Connecting
Accepting

Drawing
Imagining
Dreaming
Fantasy

Facial Recognition
Simultaneous Comprehension
Recognition of Complex Figures
Perception of Abstract Patterns

APPENDIX C

A COGNITIVE STYLES SCHOOL PROGRAM INSERVICE OUTLINE

A COGNITIVE STYLES SCHOOL PROGRAM
INSERVICE OUTLINE

I. INTRODUCTION
- A. Program Overview and Goals: Phase I
  - 1. Why such an undertaking?
  - 2. Neuroscience and neuroeducational research inservices
  - 3. Learning/cognitive styles/preferences and self-analysis
  - 4. Wholebrained teaching and learning and responsive instruction
- B. Phases II and III - Long Term Goals
- C. The Practicum Process

II. THE BRAIN
- A. Overview of Basic Physiology and Anatomy
  - 1. Historical perspectives
    - a. Analogies, metaphors and dichotomies
  - 2. Basic cellular functioning
    - a. Electro-chemical activity
  - 3. Basic anatomy
    - a. The triune brain
    - b. The lobes and cerebral hemispheres
    - c. The corpus callosum
  - 4. Developmental perspectives
    - a. Plasticity
    - b. Critical and sensitive periods
    - c. Growth spurts and plateaus
    - d. Abnormality - Medical and educational views

III. THE BRAIN/BEHAVIOR CONNECTION
- A. From Behaviorism to Information Processing Models
  - 1. The black box
  - 2. Technological Advances
    - a. Computers
    - b. Artificial Intelligence
    - c. Bio-medical/brain monitoring
- B. Localization of Function
  - 1. Pathological conditions
  - 2. Mapping
  - 3. Contralateral Control
- C. Cerebral Lateralization and Hemispheric Specialization
  - 1. Left-hemisphere dominance
  - 2. Right-hemisphere dominance
  - 3. Processing vs. function
  - 4. Metaphorically speaking
- D. Two Hemispheres - One Brain
  - 1. Corpus callosum
  - 2. Split-brain research
  - 3. Wholebrained functioning

IV. LEARNING STYLES AND COGNITIVE PROCESSING
- A. The Encompassing Perspective
  - 1. Style, preference and dominance
  - 2. Affective, physiological/environmental and cognitive
- B. Focusing on Cognitive Styles
  - 1. Thinking about thinking
    - a. Herrmann's model
  - 2. What we know about ourselves and others

C. Assessment and Instrumentation
   1. Learning styles
   2. Cognitive styles and the Herrmann Brain Dominance Instrument (HBDI)
      a. Administration, interpretation and profiling
   3. Subjective Assessment and Observation

V. TEACHING/LEARNING AND COGNITIVE STYLES
   A. Teaching the Way You Learn
      1. Recognizing the connection
   B. Remediation vs. Adaptation
      1. Within the individual
         a. Strategy deficiencies
         b. Thinking skills weaknesses
         c. Metacognition
      2. Within the environment
         a. Physical
         b. Social/instructional
   C. Matching
      1. Processes not people
      2. Diversification is best
   D. Wholebrained Instruction
      1. Systematic
         a. Heterogeneous groups
      2. Capitalizing Upon Both Hemispheres
         a. Creativity
         b. Problem solving
         c. Historically
   E. Responsive Instruction
      1. Homogeneous Groups
         a. Systematic sorting
         b. Curriculum casualties
         c. At risk populations

VI. MAKING THE COGNITIVE STYLES MODEL WORK

- A. Phase I as the Foundation
  - 1. Organizing what you already know
  - 2. Compatibility of the cognitive styles model with other methods and instructional strategies
- B. Lesson Plan Development
  - 1. Integrating the Herrmann Model
- C. Coaching
  - 1. Technical
  - 2. Peer/collegial
  - 3. Challenge
- D. System and Organizational Support
  - 1. Effective schools process
    - a. Decentralization
    - b. School Improvement Teams and the "processes"
    - c. Student Outcomes
  - 2. Maximizing Achievement Potential (MAP)
  - 3. Chapter I
  - 4. Transitional First Grade
- E. Phases II and III
  - 1. Student Assessment
  - 2. Integration into the Curriculum
    - a. Thinking skills
    - b. Strategic problem solving
    - c. Cognitive behavior modification and metacognition

APPENDIX D

BASIC NEUROSCIENCE AND NEUROEDUCATIONAL RESEARCH INSERVICE OBJECTIVES EVALUATION INSTRUMENT

Basic Neuroscience and Neuroeducational Research
Inservice Objectives Evaluation Instrument

Name:_____ School:_____ Date:_____

DIRECTIONS: Select from the key and fill in the blank with the most appropriate response. Each entry will be used once. There are no distractor entries in the key.

1. The brain's physiological functioning can best be described in terms of _____.

2. The _____ is comprised of the reptilian complex, limbic system and neocortex.

3. The cerebral cortex is anatomically divided into two _____, of from another anatomical perspective the _____ lobes.

4. The two sides of the brain are bridged by means of a nerve bundle known as the _____.

5. The brains of most individuals show signs of _____ at an early age. This is when one side of the brain develops a facility for a particular type of processing or problem solving.

6. The research of Broca, Wernicke and Penfield led to increased interest and study of the _____. Their contributions were particularly useful to neuro-surgeons during delicate brain operations.

7. Sperry's research into the _____ phenomena provided much of the impetus for further hemisphere related research.

8. While the brain is incredibly flexible, certain developmental acquisitions (i.e., language) appear to be best accomplished during _____.

9. _____ is the term used to describe the brain's ability to compensate and adapt to developmentally unusual functional demands (i.e., relearning to speak following trauma to the left hemisphere of the brain).

10. Epstein's research into the _____ of the brain may provide physiological evidence in support of Piaget's theory of cognitive development.

11. Sex related differences with regard to the brain and its functioning have been investigated for years. The apparent interhemispheric advantages seen in _____ may offer a general explanation as to why _____ are nearly 10 times more likely to suffer from language disorders and reading problems.

12. The _____ in education has grown in prominence, in part, as a result of our limited understanding of brain function. Because focus was only on the "stimulus and response," the brain became referred to as the _____.

13. Technological advances in computers and brain monitoring have been responsible, to a large extent, for the more cognitive and _____ theories and models of brain functioning.

14. _____ serve as tools when conceptualizing the brain and its complex functioning.

15. Information processing models have offered a great deal in the way of providing the foundation for conceptualizing the cognitive processing of the general population, and the _____ student population more specifically.

16. The term _____ refers to the knowledge about oneself as a learner, and the regulation and control of learning behaviors.

17. Generally speaking, the concept of _____ control refers to the functional organization of the brain where the left hemisphere controls the functions of the right side of the body, and vice versa.

18. Despite _____, the brain functions best when the tremendous capabilities of both hemispheres are combined.

19. Instructional techniques, strategies and materials which stimulate the brain bilaterally are often referred to as _____ approaches.

20. The patterns of behavior most characteristic of an individual's usual processing (i.e., thinking, remembering problem solving) referred to as the individual's _____.

21. Our sensory systems and motor behavior often reflect habits and patterns of functioning that are useful in examining when trying to understand the concepts of _____.

22. The umbrella term _____ is used to encompass affective, physiological/environmental and cognitive dimensions of the learner.

23. Instructional _____ focuses on manipulating the factors external to the child (i.e., materials, environment, methods) to bring about optimal learning.

24. Instructional _____ emphasizes the retraining of the learner so as to provide the skill and knowledge necessary to meet the demands of the learning environment.

25. The research indicates that most "traditional" instructional approaches to curriculums systematically exclude _____ students from appropriate educational experiences.

RESPONSE KEY:

- learning style
- adaptation
- electro-chemical activity
- information processing
- triune brain system
- females
- contralateral
- sensitive periods
- wholebrained
- plasticity
- males
- growth spurts
- hemispheric specialization
- frontal, parietal, occipital and temporal
- dominance & preference
- black box
- localization of function
- split brain
- analogies & metaphors
- right brained
- hemispheres
- behavioristic movement
- cognitive style
- corpus callosum
- metacognition
- learning disabled
- remediation
- hemispheric dominance and/or cognitive style/preference

Directions: Enter "T" or "F" in the space provided indicating whether the statements are true or false.

___ 1. Students learn best when a task or skill is analyzed and broken down into small independent instructional units and presented in a sequential manner.

___ 2. Even with well developed lesson plans and instruction, several students in each classroom will be unable to grasp what is being taught.

___ 3. The research indicates that teaching style is a product of professional training and education.

___ 4. The fact is that the vast majority of teaching in America's schools is comprised of listening to a teacher lecture and seat work.

___ 5. Historically, teacher education and training programs have integrated course work in basic neuroscience and neuroeducational research into their core curriculum.

___ 6. Linguistic and logical/mathematical approaches to teaching are not often employed in America's schools.

___ 7. Generally, it is the approaches to teaching that have more to do with putting students "at risk" educationally than does their intelligence, socio-economic status or home environment.

___ 8. From a educational standpoint, equality and equity are the same thing.

___ 9. Often it is the curriculum that is accommodated not students.

___ 10. Research indicates that employing "traditional" instructional approaches is an effective means of "sorting" students.

___ 11. School systems in America have always provided inservice training to teachers so as to keep their professionals current with regard to neuroeducational research and developments.

___ 12. Wholebrained instruction may be considered "responsive" instruction when faced with heterogeneous groups.

___ 13. To best understand the learning/cognitive style of another, one should first develop an appreciation for, and understanding of, their own learning/cognitive style.

___ 14. Educational experiences outside of the mainstream (i.e., pull-out programs) are necessary when teachers are faced with students who are grouped heterogeneously.

___ 15. Teachers have long recognized the need for alternative instructional approaches in order to meet the diverse individual needs of their students.

___ 16. Girls are nearly 10 times more likely to experience learning problems (i.e., reading and language) during their elementary school years.

___ 17. When it comes to following the curriculum, an over emphasis on "doing things right" can prevent individuals from "doing the right thing."

___ 18. The most efficient and effective instructional programs standardize teaching methodology.

___ 19. Most teachers are fully aware of how their cognitive processing style/preference impacts their selection and implementation of instructional methodologies.

___ 20. Knowing your own cognitive style and the styles of your students will help bring about systematically responsive instruction and improved achievement.

Descriptors Associated with Cerebral Dominance

Directions: Enter "R" or "L" in the space provided, indicating association with right or left cerebral hemisphere functioning and/or dominance.

___ Verbal	___ Innovative
___ Simultaneous	___ Mathematical
___ Writing	___ Convergent
___ Spatial	___ Gestalt
___ Relational	___ Analytic
___ Integrative	___ Successive
___ Numerical	___ Emotional
___ Metaphoric	___ Global
___ Minor	___ Rational
___ Temporal	___ Quantitative
___ Dominant	___ Holistic
___ Intuitive	___ Divergent
___ Artistic	___ Approximator
___ Critical	___ Technical
___ Musical	___ Model Builder
___ Synthesizer	___ Linear
___ Factual	___ Naming
___ Precise	___ Ordering
___ Fantasy	___ Drawing
___ Detailed	___ Nonverbal
___ Facial Recognition	___ Creative
___ Organizing	___ Logical
___ Sequential	___ Conservative
___ Imagining	___ Dreaming
___ Reading	___ Administrative
___ Perception of Abstract Figures	___ Recognition of Complex Patterns

APPENDIX E

BASIC NEUROSCIENCE AND NEUROEDUCATIONAL RESEARCH INSERVICE OBJECTIVES EVALUATION INSTRUMENT ANSWER-KEYS

Basic Neuroscience and Neuroeducational Research Inservice Objectives Evaluation Instrument

ANSWER KEY - FILL-IN-THE-BLANK

1. The brain's physiological functioning can best be described in terms of ___electro-chemical activity_____.

2. The _____triune brain system_____ is comprised of the reptilian complex, limbic system and neocortex.

3. The cerebral cortex is anatomically divided into two _____hemispheres_____, of from another anatomical perspective the _____frontal, parietal, occipital and temporal_____ lobes.

4. The two sides of the brain are bridged by means of a nerve bundle known as the _____corpus callosum_____.

5. The brains of most individuals show signs of _____hemispheric specialization____ at an early age. This is when one side of the brain develops a facility for a particular type of processing or problem solving.

6. The research of Broca, Wernicke and Penfield led to increased interest and study of the _____localization of function____. Their contributions were particularly useful to neuro-surgeons during delicate brain operations.

7. Sperry's research into the _____split brain_____ phenomena provided much of the impetus for further hemisphere related research.

8. While the brain is incredibly flexible, certain developmental acquisitions (i.e., language) appear to be best accomplished during _____sensitive periods_____.

9. _____Plasticity_____ is the term used to describe the brain's ability to compensate and adapt to developmentally unusual functional demands (i.e., relearning to speak following trauma to the left hemisphere of the brain).

10. Epstein's research into the _____growth spurts_____ of the brain may provide physiological evidence in support of Piaget's theory of cognitive development.

11. Sex related differences with regard to the brain and its functioning have been investigated for years. The apparent interhemispheric advantages seen in _____females_____ may offer a general explanation as to why _____males_____ are nearly 10 times more likely to suffer from language disorders and reading problems.

12. The _____behavioristic movement____ in education has grown in prominence, in part, as a result of our limited understanding of brain function. Because focus was only on the "stimulus and response," the brain became referred to as the _____black box_____.

13. Technological advances in computers and brain monitoring have been responsible, to a large extent, for the more cognitive and ____information processing_____ theories and models of brain functioning.

14. ____Analogies & metaphors____ serve as tools when conceptualizing the brain and its complex functioning.

15. Information processing models have offered a great deal in the way of providing the foundation for conceptualizing the cognitive processing of the general population, and the _____learning disabled_____ student population more specifically.

16. The term _____metacognition_____ refers to the knowledge about oneself as a learner, and the regulation and control of learning behaviors.

17. Generally speaking, the concept of _____contralateral_____ control refers to the functional organization of the brain where the left hemisphere controls the functions of the right side of the body, and vice versa.

18. Despite ___hemispheric dominance and/or cognitive style/preference___, the brain functions best when the tremendous capabilities of both hemispheres are combined.

19. Instructional techniques, strategies and materials which stimulate the brain bilaterally are often referred to as _____wholebrained_____ approaches.

20. The patterns of behavior most characteristic of an individual's usual processing (i.e., thinking, remembering problem solving) referred to as the individual's ___cognitive style_____.

21. Our sensory systems and motor behavior often reflect habits and patterns of functioning that are useful in examining when trying to understand the concepts of __dominance & preference__.

22. The umbrella term _____learning style_____ is used to encompass affective, physiological/environmental and cognitive dimensions of the learner.

23. Instructional _____adaptation_____ focuses on manipulating the factors external to the child (i.e., materials, environment, methods) to bring about optimal learning.

24. Instructional _____remediation_____ emphasizes the retraining of the learner so as to provide the skill and knowledge necessary to meet the demands of the learning environment.

25. The research indicates that most "traditional" instructional approaches to curriculums systematically exclude _____right brained_____ students from appropriate educational experiences.

ANSWER KEY - TRUE AND FALSE

_F_ 1. Students learn best when a task or skill is analyzed and broken down into small independent instructional units and presented in a sequential manner.

_F_ 2. Even with well developed lesson plans and instruction, several students in each classroom will be unable to grasp what is being taught.

_F_ 3. The research indicates that teaching style is a product of professional training and education.

_T_ 4. The fact is that the vast majority of teaching in America's schools is comprised of listening to a teacher lecture and seat work.

_F_ 5. Historically, teacher education and training programs have integrated course work in basic neuroscience and neuroeducational research into their core curriculum.

_F_ 6. Linguistic and logical/mathematical approaches to teaching are not often employed in America's schools.

_T_ 7. Generally, it is the approaches to teaching that have more to do with putting students "at risk" educationally than does their intelligence, socio-economic status or home environment.

_F_ 8. From a educational standpoint, equality and equity are the same thing.

_T_ 9. Often it is the curriculum that is accommodated not students.

_T_ 10. Research indicates that employing "traditional" instructional approaches is an effective means of "sorting" students.

_F_ 11. School systems in America have always provided inservice training to teachers so as to keep their professionals current with regard to neuroeducational research and developments.

_T_ 12. Wholebrained instruction may be considered "responsive" instruction when faced with heterogeneous groups.

_T_ 13. To best understand the learning/cognitive style of another, one should first develop an appreciation for, and understanding of, their own learning/cognitive style.

_F_ 14. Educational experiences outside of the mainstream (i.e., pull-out programs) are necessary when teachers are faced with students who are grouped heterogeneously.

_T_ 15. Teachers have long recognized the need for alternative instructional approaches in order to meet the diverse individual needs of their students.

_F_ 16. Girls are nearly 10 times more likely to experience learning problems (i.e., reading and language) during their elementary school years.

_T_ 17. When it comes to following the curriculum, an over emphasis on "doing things right" can prevent individuals from "doing the right thing."

_F_ 18. The most efficient and effective instructional programs standardize teaching methodology.

_F_ 19. Most teachers are fully aware of how their cognitive processing style/preference impacts their selection and implementation of instructional methodologies.

_T_ 20. Knowing your own cognitive style and the styles of your students will help bring about systematically responsive instruction and improved achievement.

ANSWER KEY - DISCRIPTORS ASSOCIATED WITH CEREBRAL DOMINANCE

_L_ Verbal
_R_ Simultaneous
_L_ Writing
_R_ Spatial
_R_ Relational
_R_ Integrative
_L_ Numerical
_R_ Metaphoric
_R_ Minor
_L_ Temporal
_L_ Dominant
_R_ Intuitive
_R_ Artistic
_L_ Critical
_R_ Musical
_R_ Synthesizer
_L_ Factual
_L_ Precise
_R_ Fantasy
_L_ Detailed
_R_ Facial Recognition
_L_ Organizing
_L_ Sequential
_R_ Imagining
_L_ Reading
_R_ Perception of Abstract Figures

_R_ Innovative
_L_ Mathematical
_L_ Convergent
_R_ Gestalt
_L_ Analytic
_L_ Successive
_R_ Emotional
_R_ Global
_L_ Rational
_L_ Quantitative
_R_ Holistic
_R_ Divergent
_R_ Approximator
_L_ Technical
_R_ Model Builder
_L_ Linear
_L_ Naming
_L_ Ordering
_R_ Drawing
_R_ Nonverbal
_R_ Creative
_L_ Logical
_L_ Conservative
_R_ Dreaming
_L_ Administrative
_R_ Recognition of Complex Patterns

APPENDIX F

INDIVIDUAL HBDI PROFILE EVALUATION INSTRUMENT

Individual HBDI Profile Evaluation Instrument

Name:_____ **School:**_____ **Date:**_____

DIRECTIONS: Using your knowledge of the HBDI and your "Personal Profile," complete the tasks described below.

Given the blank HBDI profile below, complete the following:

A. Identify and label each of the four quadrants, to include:

1. **Descriptive names of the quadrants;**
2. **Letters corresponding to the quadrants;**
3. **Two or more terms/characteristics associated with the quadrants (i.e., processing, problem solving tasks).**

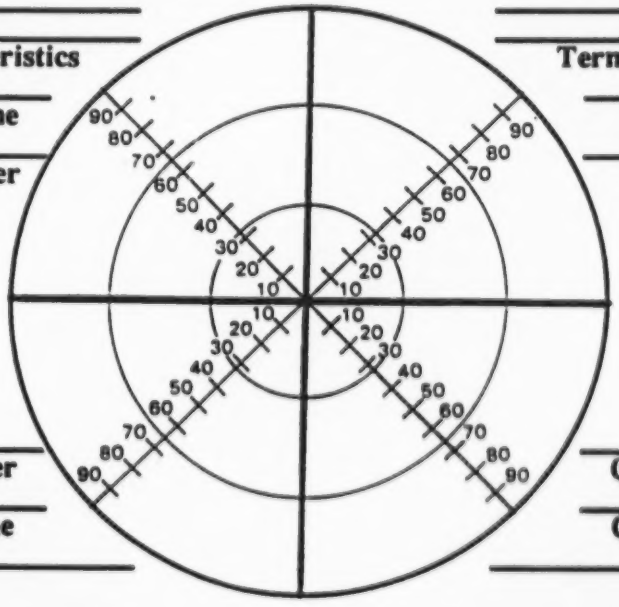
B. Assign Personal Profile Code Numbers and/or their corresponding terms to each of the quadrants.

Profile Code Number/Term | **Profile Code Number/Term**

Terms/Characteristics | **Terms/Characteristics**

Quadrant Name | **Quadrant Name**

Quadrant Letter | **Quadrant Letter**



Quadrant Letter | **Quadrant Letter**

Quadrant Name | **Quadrant Name**

Terms/Characteristics | **Terms/Characteristics**

Profile Code Number/Term | **Profile Code Number/Term**

C. Briefly describe the significance of the Profile Code Numbers and/or their corresponding terms.

D. Briefly describe the implications of your Personal Profile as it relates to your specific teaching/learning style. Please include specific behavioral descriptions/examples and touch upon each of the quadrants.

APPENDIX G

INDIVIDUAL HBDI PROFILE EVALUATION INSTRUMENT SCORING EXAMPLE

Individual HBDI Profile Evaluation Instrument

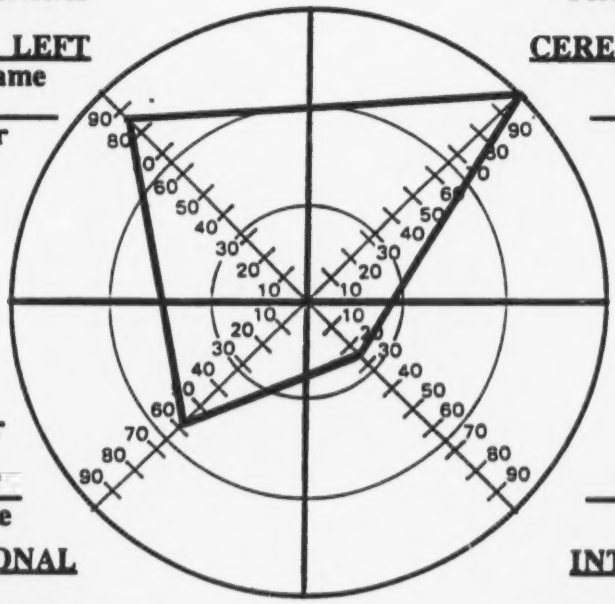
SCORING EXAMPLE

Given the blank HBDI profile below, complete the following:

A. Identify and label each of the four quadrants, to include:

1. **Descriptive names of the quadrants;**
2. **Letters corresponding to the quadrants;**
3. **Two or more terms/characteristics associated with the quadrants (i.e., processing, problem solving tasks).**

B. Assign Personal Profile Code Numbers and/or their corresponding terms to each of the quadrants.



1 - PRIMARY
Profile Code Number/Term

LOGICAL
ANALYTIC
Terms/Characteristics

CEREBRAL LEFT
Quadrant Name

A
Quadrant Letter

1 - PRIMARY
Profile Code Number/Term

CONCEPTUALIZER
HOLISTIC
Terms/Characteristics

CEREBARAL RIGHT
Quadrant Name

D
Quadrant Letter

B
Quadrant Letter

LIMBIC LEFT
Quadrant Name

ORGANIZATIONAL
PLANNER
Terms/Characteristics

C
Quadrant Letter

LIMBIC RIGHT
Quadrant Name

INTERPERSONAL
INTUITIVE
Terms/Characteristics

2 - SECONDARY
Profile Code Number/Term

3 - TERTIARY
Profile Code Number/Term

C. Briefly describe the significance of the Profile Code Numbers and/or their corresponding terms. A "primary" in any given quadrant indicates a preference for the modes in that quadrant. A "secondary" profile code indicates an ease with or a comfortable usage of the modes in that particular quadrant. While these are preferences too, they are secondary in nature as compared to your primary. "Tertiary" profile codes correspond to a lack of preference for or even avodidance of the characteristics in a quadrant. With the avoiding of certain thinking styles, the preference of other styles is much increased.

D. Briefly describe the implications of your Personal Profile as it relates to your specific teaching/learning style. Please include specific behavioral descriptions/examples and touch upon each of the quadrants. My profile is double dominant and features two primaries in the cerebral quandrants, A and D. I tend to prefer the more cognitive processing modes associated with these cerebral quadrants compared to the more visceral characteristics of the limbic mode (B and C quadrants). I am able to switch back and forth between the two cerebral modes during instruction, employing formalized lecture and unstructured-experiential techniques. More specifically, I prefer logical, analytical, quantitative modes of thinking and teaching in the Upper Left (A) quadrant along with integrative, synthesizing, imaginative, and holistic aspects of the Upper Right (D) quadrant. Sometimes I'm too critical of my student's work because of my Cerebral Left quadrant. I have a clear secondary preference in the Lower Left (B) quadrant. I like my lessons to be well organized but it's not one of my priorities. My Lower Right (C) quadrant is tertiary and constitutes my least preferred mode of functioning. I tend to avoid interpersonal and emotionally charged situations. I don't use enough positive reinforcement techniques in my classroom.

APPENDIX H

HERRMANN FOUR QUADRANT LESSON PLAN EVALUATION CHECKLIST

Herrmann Four Quadrant Lesson Plan Evaluation Checklist

Name: _____ **School:** _____
Subject: _____ **Lesson:** _____

SCORING: Submitted wholebrain lesson plans are reviewed for methods of instructional organization and presentation, student activities and learning opportunities, and the materials employed, relative to Herrmann's four quadrants.

A - Quadrant/ Cerebral Left/ Upper Left

Evidence of formalized lecture..... _____
Evidence of factual content..... _____
Opportunity to apply analysis and logic..... _____
Opportunity to think through ideas..... _____
Convergent thinking activities..... _____
Use of text books..... _____
Other..... _____
Other..... _____

Total _____ x 10 pts.

B - Quadrant/ Limbic Left/ Lower Left

Highly structured and sequential instruction..... _____
Identification of specific instructional objectives..... _____
Evidence of content organization..... _____
Programmed learning activities..... _____
Guided practices exercises..... _____
Evidence of environmental/materials organization..... _____
Structured behavior modification plan..... _____
Use of manipulatives..... _____
Other..... _____
Other..... _____

Total _____ x 10 pts.

C - Quadrant/ Limbic Right/ Lower Right

Opportunities for Experiential activities..... _____
Small group and/or cooperative learning experiences..... _____
Opportunities for listening and sharing ideas..... _____
Group discussions and activities..... _____
Instructional use of music and/or movement..... _____
Opportunities for individual attention..... _____
Other..... _____
Other..... _____

Total_____ x 10 pts.

D - Quadrant/ Cerebral Right/ Upper Right

Non-structured, self discovery activities..... _____
The purpose of instruction clearly explained..... _____
Mind-set activities/Pre-instructional organizers..... _____
Possibilities and imagination exercises..... _____
Synthesis and application exercises..... _____
Brainstorming and/or divergent thinking opportunities..... _____
Other..... _____
Other..... _____

Total _____ x 10 pts.

Summary of Scores*

A - Total _____
B - Total _____
C - Total _____
D - Total _____

Total Points for Wholebrain Lesson Plan _____

***Note: A minimum of 20 points in each quadrant (80 points for the total instrument) is necessary for mastery as indicated in the objectives.**

APPENDIX I

HERRMANN FOUR QUADRANT LESSON OBSERVATION CHECKLIST

C - Quadrant/ Limbic Right/ Lower Right

Opportunities for Experiential activities..... _____
Small group and/or cooperative learning experiences..... _____
Opportunities for listening and sharing ideas..... _____
Group discussions and activities..... _____
Instructional use of music and/or movement..... _____
Opportunities for individual attention..... _____
Other..... _____
Other..... _____

Total _____ x 10 pts.

D - Quadrant/ Cerebral Right/ Upper Right

Non-structured, self discovery activities..... _____
The purpose of instruction clearly explained..... _____
Mind-set activities/Pre-instructional organizers..... _____
Possibilities and imagination exercises..... _____
Synthesis and application exercises..... _____
Brainstorming and/or divergent thinking opportunities..... _____
Other..... _____
Other..... _____

Total _____ x 10 pts.

Summary of Scores*

A - Total _____
B - Total _____
C - Total _____
D - Total _____

Total Points for Classroom Observation _____

***Note: A minimum of 20 points in each quadrant (80 points for the total observation) is necessary for mastery as indicated in the objectives.**

Herrmann Four Quadrant Lesson Observation Checklist

Name: _____ **School:** _____ **Date:** _____

Subject: _____ **Lesson:** _____ **Grade:** _____

DIRECTIONS: Observations are made of methods of instructional organization and presentation, student activities and learning opportunities, and the materials employed, relative to a model of wholebrained instruction and Herrmann's four quadrants.

A - Quadrant/ Cerebral Left/ Upper Left

Evidence of formalized lecture..... _____
Evidence of factual content..... _____
Opportunity to apply analysis and logic..... _____
Opportunity to think through ideas..... _____
Convergent thinking activities..... _____
Use of text books..... _____
Other..... _____
Other..... _____

Total _____ x 10 pts.

B - Quadrant/ Limbic Left/ Lower Left

Highly structured and sequential instruction..... _____
Identification of specific instructional objectives..... _____
Evidence of content organization..... _____
Programmed learning activities..... _____
Guided practices exercises..... _____
Evidence of environmental/materials organization..... _____
Structured behavior modification plan..... _____
Use of manipulatives..... _____
Other..... _____
Other..... _____

Total _____ x 10 pts.

APPENDIX J

LOCAL INITIATIVES AND PROGRAMS CONSISTENT WITH PRACTICUM OBJECTIVES

Local Initiatives and Programs Consistent with Practicum Objectives

Listed below are programs already in place within the public school system as described in schools fact sheet (Board of Education of Frederick County, Department of Compensatory and Accountability Services (1987). Frederick County Public Schools 1987-1988 Fact Sheet. Frederick, MD: Author.

The "Map to Excellence Program" establishes short and long-term achievement goals for students at ten schools who may be identified "at risk." The "Maximizing Achievement Potential Toward Excellence Program" provides instructional, guidance and community resources to help the students toward achievement goals that are based on national and state standardized tests.

Transitional First Grade classrooms can be found in ten elementary schools. They serve students who are six years old but would not fully benefit if placed in regular first grade programs. The curriculum emphasizes language use and the development of social skills.

A two-teacher approach allows the revised "Accept and Challenge Program" (Chapter I) to provide direct classroom services to students identified as "high-need children" in kindergarten through second grade. By lowering student-teacher ratios in classrooms containing Chapter I students, more intensive instruction can be provided. The revision also provides community contacts, summer school programs and library facilities.

APPENDIX K

THE LOCAL SYSTEM'S COMMITMENT TO THE EFFECTIVE SCHOOL PROCESS

The Local System's Commitment to the Effective School Process

The primary mission of the writer's school system is to teach for quality learning for all students. The superintendent has proposed a "Master Plan for A Total School System Commitment To Effective Schools." The plan was based upon the principles and procedures derived from the body of knowledge known as the "Effective Schools" research. System improvement are to be achieved by focusing the policies, personnel and resources upon the goal of school improvement, school-by-school. Improvement efforts at the individual school level, classroom-by-classroom and student-by-student, are supported by the system and its resources.

The locally adopted definition of "Effective School System" is one in which resources are organized and delivered in such a way as to assure that all students within that system (regardless of race, gender, or socio-economic status) learn the essential curriculum as defined by that system. Through its statement of mission and goals, instructional program and support services, and its allocation of resources, an effective school system assures that its priorities are teaching for learning, and that its focus is on both quality and equity. Effective schools are those which achieve their teaching for learning mission by demonstrating quality and equity in their program outcomes.

Several of the characteristics or correlates of Effective Schools have had a direct bearing on this practicum undertaking. In an effort to foster "strong instructionally focused leadership" the system is committed to supporting a variety of staff development programs for teachers to strengthen their instructional expertise in assuring that all students learn the essential curriculum. To assure "opportunities for every student to

participate and to learn" the system provides resource assistance for new and experienced staff to assure that appropriate instruction in the essential curriculum is provided for all students. Schools are supported in the interpretation of disaggregated data for use in adjusting and enhancing curriculum and instructional programs for students.

In an effort to clarify the roles of each of the major components of the school system, each organizational subdivision addressed its mission and goals as they reinforce and support school-based initiatives. As an area-based school psychologist, the writer had the opportunity to participate in mission generation, needs assessment processes and goals/objectives setting activities within the context of several organizational subgroups. Some of the responsibilities of the system's components impact the role of this writer as a school psychologist, and the practicum process. Area Office responsibilities include; assisting schools with data acquisition and analysis to monitor student achievement and adjust instruction for all students, including those with special needs; and, provide professional growth opportunities to enhance strong instructional techniques/strategies among teachers.

The Division of Student Services is responsible for developing and supporting programs to meet the special needs of students to the end that all students learn the essential curriculum. The Department of Special Education, under which psychologists fall, engaged in a series of strategic planning sessions out of which emerged a departmental mission statement, needs assessment and subsequent goals/objectives setting. Ranked forth among the eight major goals was the department's responsibility to encourage program innovations which incorporate current research

findings by sanctioning pilot programs which will include evaluation procedures as part of their design.

This practicum was a pilot program which incorporated current research findings and measured program outcomes. It was consistent with the "Special Education Program Parameters" which state that the needs of educationally handicapped students are both the same and different from those of others. Special education is special in that it is built on the concept of understanding unusual learning differences among the school-aged population and meeting individual educational needs through the the implementation of effective instructional strategies.

APPENDIX L

PERMISSIONS TO USE THE HBDI AND HERRMANN MODEL SUPPORT MATERIALS

APPLIED CREATIVE SERVICES, LTD.

To Whom it May Concern;

Please consider this official permission for you to reproduce the HERRMANN PARTICIPANT SURVEY FORM, HERRMANN TWENTY QUESTIONS, and the HERRMANN CONSOLIDATED SCORESHEET, which together, make up the Herrmann Brain Dominance Instrument. You may reproduce these in any quantities required for you to meet your application needs in use of this Instrument.

Sincerely,

Ned Herrmann

Ned Herrmann
President
Applied Creative Services,Ltd.
Quadra, Inc.

2075 BUFFALO CREEK ROAD, LAKE LURE, NC 28746 • (704) 625-9153

THE NED HERRMANN GROUP
APPLIED CREATIVE SERVICES, LTD.

April 11, 1989

Tom Craney, Ph.D.
2180 Duvall Road
Woodbine, MD 21797

Dear Tom:

Please consider this permission to make use of the Herrmann Brain Dominance Instrument backup materials and various whole brain models and diagrams in your dissertation.

Sincerely yours,

Ned Herrmann
President

WEH:smc

2075 BUFFALO CREEK ROAD, LAKE LURE, NC 28746
(704) 625-9153 • FAX: (704) 625-2198

APPENDIX M

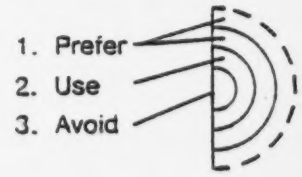
EXAMPLE OF HERRMANN BRAIN DOMINANCE PROFILE AND CONSOLIDATED SCORE SHEET

HERRMANN BRAIN DOMINANCE PROFILE

GENERIC PROFILE
CODE : 1 3 2 1

Quadrant:	A	B	C	D
Profile Code:	1	3	2	1
Adjective Pairs:	8	1	7	8
Profile Score:	87	30	65	116

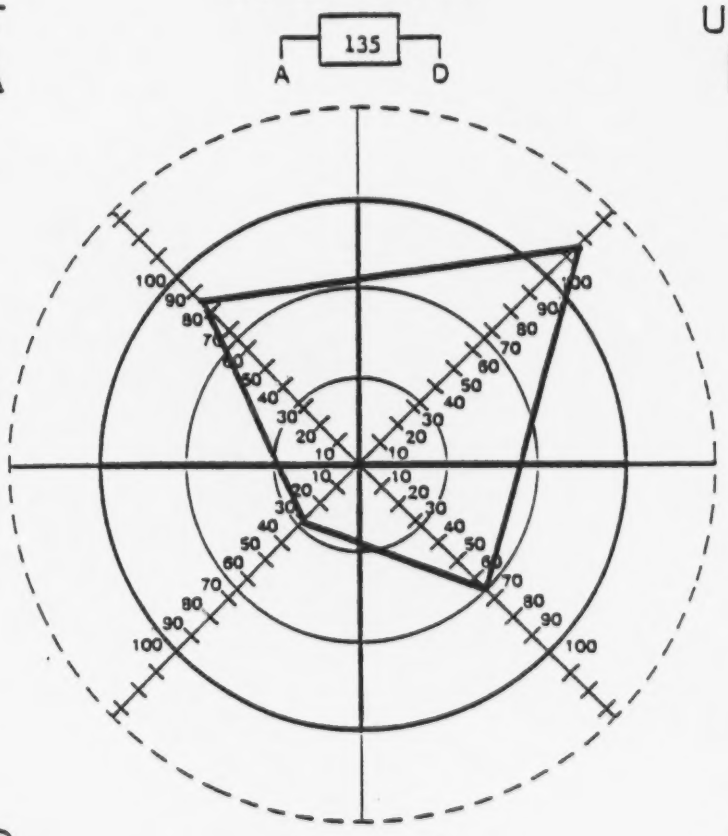
PROFILE DATA SUMMARY



CEREBRAL MODE

UPPER LEFT
A
Logical
Analyzer
Mathematical
Technical
Problem Solver

UPPER RIGHT
D
Imaginative
Synthesizer
Artistic
Holistic
Conceptualizer



Controlled
Conservative
Planner
Organizational
Administrative
B
LOWER LEFT

Interpersonal
Emotional
Musical
Spiritual
Talker
C
LOWER RIGHT

© 1986, Ned Herrmann

HERRMANN BRAIN DOMINANCE INSTRUMENT
CONSOLIDATED SCORE SHEET

NAME:
OCCUPATION:

GROUP: 362/4599.00
GENDER: MALE

CODE: 1 3 2 1

	COLUMN A UPPER LEFT	COLUMN B LOWER LEFT	COLUMN C LOWER RIGHT	COLUMN D UPPER RIGHT
KEY DESCRIPTORS (circle = most descriptive)	Factual Quantitative Critical x Rational Mathematical Logical x Analytical x	Conservative Controlled Sequential Detailed Dominant Speaker Reader	Emotional x Musical Spiritual Symbolic Intuitive * Talker Reader	Imaginative Artistic Intuitive * Holistic x Synthesizer x Simultaneous x Spatial
WORK ELEMENTS (5 = most, 1 = least)	Analytical 5 Technical 4 Problem Solving 5 Financial 2	Organization 1 Planning 1 Administrative 2 Implementation 3	Teaching 3 Writing 3 Expressing 4 Interpersonal 5	Integration 4 Conceptualizing 5 Creative 4 Innovating 3
BEST/WORST SUBJECTS	XXX			X
EDUCATION	X	X	X	X
OCCUPATION		X	XXX	XXX
HOBBIES	XXX	XXX		X

	PRIMARILY RIGHT	RIGHT/ SOME LEFT	MIXED	LEFT/ SOME RIGHT	PRIMARILY LEFT
HANDEDNESS		X			

	LEFT	DISTRIBUTED	RIGHT
LANGUAGE CENTER	X		

	DAY	EQUAL	NIGHT
ENERGY LEVEL	X		

	I	II	III	IV	V
MOTION SICKNESS		X			

INTROVERT/EXTROVERT: INT ◄- |—|—|—|—|—|—|—|—|—|—| -► EXT

ADJECTIVE PAIRS	8	1	7	8
PROFILE SCORES	87	30	65	116

APPENDIX N

EXAMPLE OF HERRMANN BRAIN DOMINANCE PROFILE SCHOOL GROUP COMPOSITE

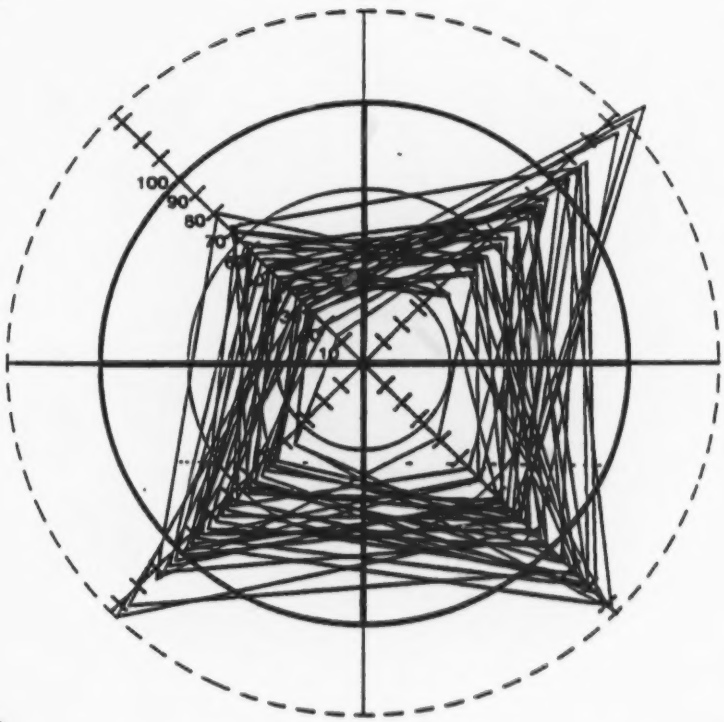
HERRMANN BRAIN DOMINANCE PROFILE

GROUP COMPOSITE
for
ELEMENTARY

CEREBRAL MODE

UPPER LEFT
Logical
Analyzer
Mathematical
Technical
Problem Solver
A

UPPER RIGHT
D
Imaginative
Synthesizer
Artistic
Holistic
Conceptualizer



LEFT MODE

RIGHT MODE

Controlled
Conservative
Planner
Organizational
Administrative
B
LOWER LEFT

Interpersonal
Emotional
Musical
Spiritual
Talker
C
LOWER RIGHT

LIMBIC MODE

© 1986, Ned Herrmann

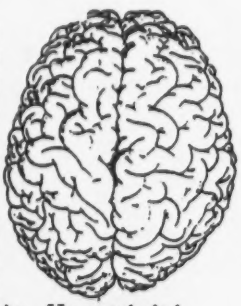
APPENDIX O

HBDI PROFILE INTERPRETATION AND SUPPORT MATERIALS

BRAIN DOMINANCE TECHNOLOGY

Early Research

Speculation and fascination about the structure and function of the human brain has gone on for thousands of years. The discovery of hemispheric specialization has its roots in ancient Greece. As early as 400 b.C., Hippocrates noted that injuries to the left side of the head often resulted in impaired function to the right side of the body and vice versa. Hippocrates concluded from these observations that "the brain of man is double."



In the 19th century, researchers began to focus on the left hemisphere as the possible location of our ability to speak. A doctor named Marc Dax presented a short paper in 1836 describing his observations of patients who had lost their ability to speak (aphasia). He noticed that many of these patients who had lost their speech ability had sustained damage to the left side of the brain. He concluded that the hemispheres controlled different functions. The left side controlled speech. Gradually, interest increased in the scientific community as to whether or not the functions of the brain were localized. After conducting post mortem studies on the victims of aphasia, the French surgeon, Paul Broca, came to the conclusions in 1864 that the location of speech is in the left hemisphere.

Shortly thereafter, the British neurologist, John Hughlings Jackson, proposed the concept of cerebral dominance and stated that the left side of the brain was the "leading" hemisphere. Later research has shown that this is not always the case. However, the left language center hemisphere does show itself more strongly, as it contains the center for speech.

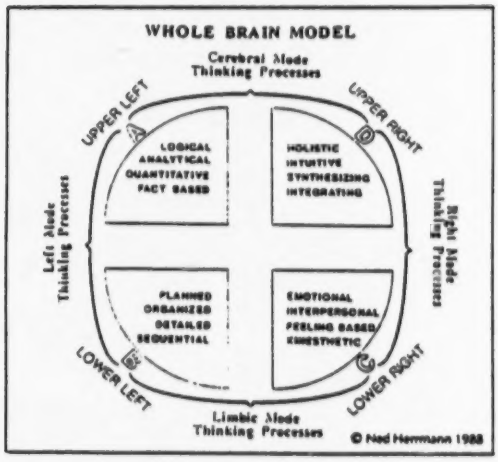
In the early 1940's, William van Wagenen performed the first "split-brain" surgery to control epileptic seizures. These early operations were not very successful, mostly because only parts of the corpus callosum (the bundle of nerves that connect the left and right hemispheres) were severed, and not the entire bundle of nerves. Later experiments by surgeons, Philip Vogel and Joseph Bogen, were highly successful in controlling epileptic seizures, and later testing of these patients by Roger Sperry and his associates resulted in much of the knowledge of the specialization of the hemispheres as we now know it. That is, that the left hemisphere is responsible for speech, linear, analytic and rational thought, and that the right hemisphere is more holistic, conceptual, emotive, and spatial.

In the 1950's, Paul MacLean developed the concept of the triune brain. His research indicated that the human brain consisted of three layers--each layer corresponding to a different stage of evolution and responsible for different kinds of mental processing. The inner most layer, he identified as the reptilian brain. This part of the brain is the earliest to develop and the most primitive. The middle layer of the brain is known as the limbic system. It deals with emotion, form and sequence, and is involved in memory transformation and retrieval. The outer, or cerebral layer, is the most recent to develop. Cognitive and intellectual thought characterizes the processes that take place in the cerebral portion of the brain.

Ned Herrmann began his research in 1976 as a result of his personal interest in locating the source of creativity. His search led him to trying to find an instrument or method of testing that would measure brain dominance or our preferred ways and modes of thinking. Not finding any, it led Ned to the creation of the Herrmann Brain Dominance Instrument. His first attempts to measure brain dominance were based on EEG measurements of brain waves generated by individuals doing specific tasks. Although the results of these tests showed the differentiation between the hemispheres, the method proved to be slow, expensive, and difficult for the subjects involved. Ned then shifted his attention to the development of a pencil-and-paper instrument as a potentially more successful approach. The results of this application led to the design of the Herrmann Brain Dominance Instrument, and which has now been completed by over 500,000 individuals. It has proven to be extremely useful in a wide variety of applications, most notably in staffing, team building, teaching and learning, creativity, counseling, and self-understanding. Creativity training and team building are among the most prominent business applications.

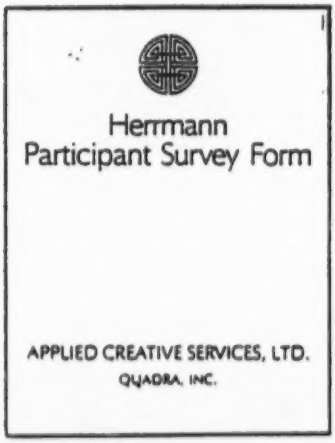
HERRMANN BRAIN DOMINANCE MODEL

The Herrmann Brain Dominance Model was developed by Ned Herrmann as a metaphorical interpretation of how we think and of what our preferred modes of knowing are. The following model has been developed by incorporating both the research of Roger Sperry and Paul MacLean.



The Herrmann Brain Dominance Model contains four distinct thinking styles, those incorporating the left and right hemispheres, as well as those incorporating the upper (cerebral) and lower (limbic) parts of the brain. Thinking process can therefore be described as upper (cerebral) left, lower (lower) left, lower (limbic) right, or upper (cerebral) right. To facilitate your understanding, these four thinking processes will be referenced in the following way: Upper Left = A; Lower Left = B; Lower Right = C; Upper Right =D.

The upper left A modes of thinking can be thought of as analytical, mathematical, technical, and problem solving. The lower left B can be thought of as controlled, conservative, planned, organized, and administrative in nature. The lower right C is interpersonal, emotional, musical, spiritual, and the "talker" modes. The upper right D contains the imaginative, synthesizing, artistic, holistic, and conceptual modes.

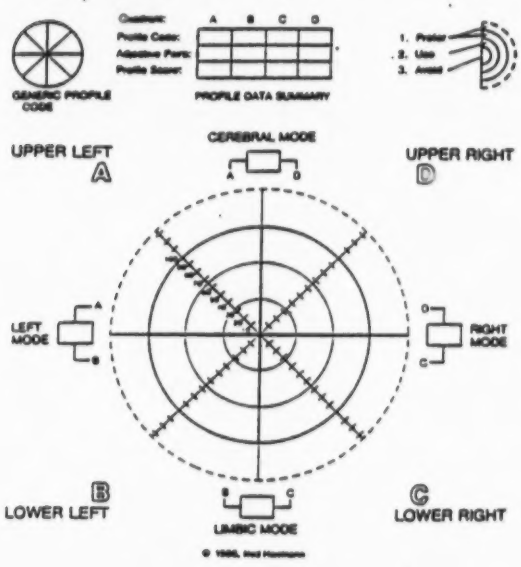


The Herrmann Participant Survey Form, (which is the questionnaire portion of the Brain Dominance Instrument you have completed), provides the data, which when processed, indicates the degree of preference or lack of preference you have for these four quadrants. Each of us by nature and nurture develop a preferred mode of knowing: a particular way in which we see the world, process information, or make decisions. The Herrmann Brain Dominance Profile, therefore indicates the degree of preference an individual has for each kind of thinking styles, represented by each of the four quadrants, compared to the other quadrants.

The Herrmann Brain Dominance Profile does not determine whether one kind of thinking is "better" than another. Different situations require different kinds of thinking and understanding. Your brain dominance profile will enable you to optimize your ability to use the thinking that is appropriate to a given situation.

The statistical data display coupled with the visual display of your profile, will help you understand how you think, communicate, solve problems, and make decisions. It will also show you why, for instance, you may communicate more easily with some people than others, or what elements of your work are more satisfying than others. The implications of this are far reaching and contribute to many areas. Team building, productivity, learning preferences, career choices, family communications and personal growth are just a few examples. For each individual, the Herrmann Brain Dominance Profile can provide the basis of a better and more comprehensive understanding of self.

HERRMANN BRAIN DOMINANCE PROFILE



Your visual profile display is the visual representation of your Total Profile Scores (also found on the bottom of the Consolidated Scoresheet). The scores are plotted on four axes, each one representing one of the four quadrants of the brain, creating a metaphorical model. This model is read counter-clockwise from the Upper Left a to Lower Left B to Lower Right C to Upper Right D. As a guide to aid in the interpretation of these profile scores, we also determine a "Generic Profile Code," found above the visual profile.

The terms, "Primaries, Secondaries, Tertiaries," are the way the profile code numbers 1, 2, 3 are designed on the scoresheet and referred to in this booklet. Please note the profile key on the scoresheet. The following will help you better understand the meaning of the terms used.

Primaries: "1" - Scores 67 and higher

In any given quadrant, a "primary" indicates *preference* for the modes in that quadrant. It is possible you have two or more "primaries" in your profile code. Our data shows that all profile codes show at least one primary.

Secondaries: "2" - Scores 34 - 66

A secondary in your profile code indicates an ease with or a comfortable usage of the modes in a given quadrant. These are also preferences, but *secondary* in nature as compared to your primary.

Tertiaries: "3" - Scores 0 - 33

A tertiary score corresponds to a lack of preference for or even avoidance of the characteristics in a quadrant. Tertiaries in your profile code strengthen the opposing primaries. In avoiding certain thinking styles, the preference of other styles is that much increased.

Around the visual display, you will note four boxes at the North, South, East, and West positions. These indicate your total dominance scores for combined modes. These include the cerebral mode (quadrants A & D, upper left and right), the left mode, (quadrants A & B, upper and lower left), the limbic mode (quadrants B & C, lower left and lower right), and the right mode, (quadrants C & D, lower and upper right). These totals represent a summary score of all the data in each *mode*. Comparing total scores will help illustrate the degree of "tilt" or preference you have for the left mode over the right for example or the cerebral mode over the limbic.

The Profile Data Summary box at the top of the sheet shows your profile code, your adjective pair scores and your profile scores for each quadrant.

The adjective pair scores represent the numeric results of the forced-choice pairings that were included in the Herrmann Participant Survey Form. Please refer to the Consolidated Scoresheet description for more information on these scores and their implications.

Remember that your brain dominance profile is not good or bad, right or wrong--it simply is! It is a metaphor expressing your mental preference in a way designed for easy comprehension. Also be aware that your profile represents a distribution of preferences, not competencies. While there is a close correlation between the two, they are entirely different. Competence must be acquired through education, training, and expression, but the achievement of mastery is greatly favored by a preference in that area of knowing.

HERRMANN BRAIN DOMINANCE INSTRUMENT
CONSOLIDATED SCORE SHEET

Your brain dominance consolidated scoresheet will show you how your data has been diagnosed and how it results in a specific profile based on your unique thinking styles. This profile shows the location and intensity of your preferred modes of thinking in each of the four quadrants.

Looking at the statistical display, you will note the consolidated scoresheet is divided into four columns--two on the left and two on the right. Reading the sheet from left to right, the four columns represent the data groupings for upper left A, lower left B, lower right C, and the upper right D quadrants of the Herrmann Brain Dominance Model. The color of each column corresponds to the appropriate quadrant on the Visual Display.

Your profile code, as described in the Visual Display segment, is found at the top of the page. Next, the *Key Descriptors* and *Work Elements* sections are arranged in the four separate columns corresponding to the four quadrants. The data for both sections has simply been rearranged so as to be displayed in the appropriate quadrants. The intensity of your preferred quadrants is shown by asterisk or by number. In Key Descriptors, the adjectives chosen by you are represented by an "x," except for the adjectives that were changed from a 2 to a 3, which is asterisked (that being the word you chose as best describing you). In the Work Elements category, the number you assigned to each work element on a scale from 1 to 5 is indicated. The greater the number of descriptors and high numeric values in a quadrant, the stronger your preferences in that quadrant will be.

The *Best/Worst Subjects*, *Educational Major*, and *Occupational and Hobby* sections are completed by a series of "x"s. The more "x"s, the greater the intensity. You can note which quadrant these fall in by following the same A, B, C, D pattern of Upper Left, Lower Left, Lower Right, and Upper Right.

The location of your *Language Center* is determined by Questions 4 and 5 on the Herrmann Participant Survey Form. If you hold your pencil as in example A or C, with a lack of tilt, your language center is left, which is most common. Those marked B or D, with the tilt, will be checked right. If you marked option C (both hands are equal), your language center is then distributed. Be sure you consider your natural handedness, rather than one you may have been forced to learn.

The line for *Handedness* is taken directly off your answers on the Survey Form indicating whether you have a strong right to a strong left preference in your handedness.

Both *Energy Level* and *Motion Sickness* are areas that are worth noting as they do seem to indicate dominance. Right mode people tend to be more susceptible to motion sickness, while left mode people, because of a certain amount of control, will perhaps not allow themselves to be sick. Left mode people more often identify themselves as day people. Recognize that these are trends in the data and there are many individual exceptions to these trends.

The *Introversion/Extroversion* scale, again is indicated by your selection on the Participant Survey Form, as well as your answers to the Twenty Questions data. There is a notable trend that left brain dominant people tend to be more introverted and right brain dominant people tend to be more extroverted.

The *Adjective Pair Scores* represent the numeric results of the forced-choice pairings that were included in the Herrmann Participant Survey Form. This section pairs each descriptor of each quadrant against the other three quadrants. This is often the most difficult

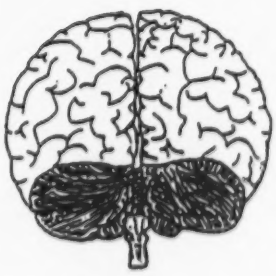
BEST COPY AVAILABLE

section for people to complete. These scores are reflective of your preferred modes of thinking as they are numerically distributed among the four quadrants. The adjective pair scores are typically in direct correlation with the profile scores.

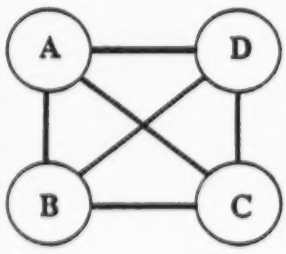
The *Profile Scores* for each quadrant are the total numeric summation of your data for each quadrant. They are also the scores used to create the visual display of your profile on the companion visual scoresheet.

Evolution of the Whole Brain Concept

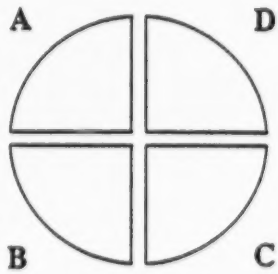
PHYSIOLOGY➞ARCHITECTURE ➞ METAPHOR ➞ APPLICATION



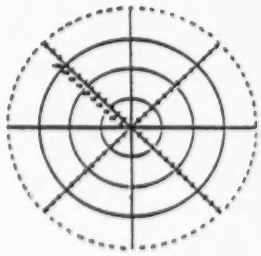
THE BRAIN



THE ORGANIZING PRINCIPLE



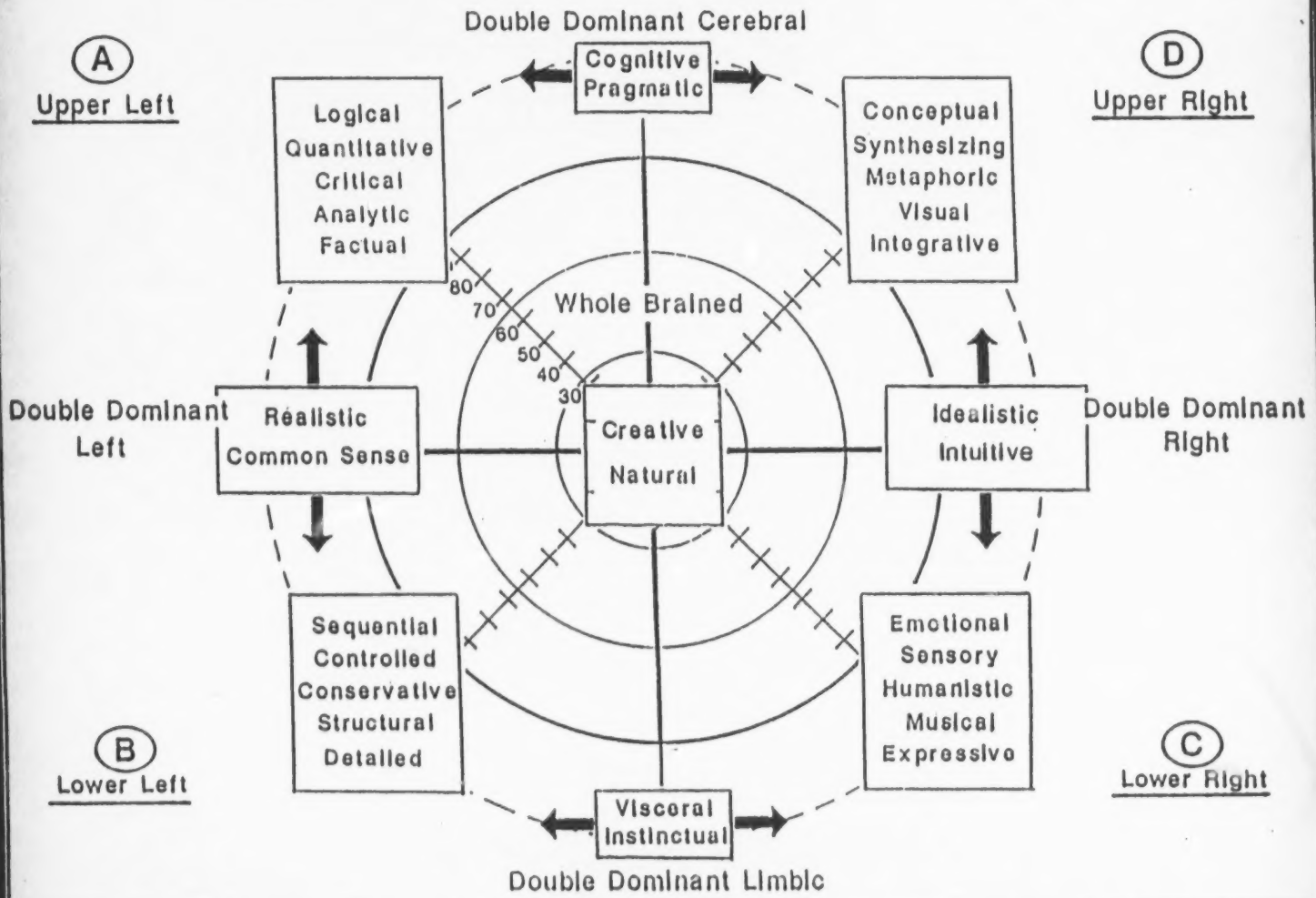
THE WHOLE BRAIN MODEL



THE BRAIN DOMINANCE PROFILE

© 1986 NED HERRMANN

THE UNIVERSE OF THINKING STYLES



© 1987, Ned Herrmann

APPENDIX P

PARTICIPANT RESPONSE FORM

PARTICIPANT RESPONSE FORM*

TITLE: A Cognitive Styles School Program **DATE:**

We need your help in evaluating the effectiveness of this staff development presentation. Your remarks will assist us in continuing to provide staff development opportunities of high quality. Please indicate your degree of agreement with each statement by placing a check mark in the appropriate box.

This Workshop:	Strongly Agree	Agree Somewhat	Undicided	Disagree Somewhat	Strongly Disagree
1. was just what I expected ...					
2. required active participant involvement					
3. accomplished its listed objectives very well					
4. required a reasonable amount of homework for me					
5. would be of great value to others in my building ...					
6. was a stimulating experience.....					
7. was practical					
8. should be offered again next year					
9. will help me in my job					

10. My overall evaluation is (circle one):

Outstanding Very Good Satisfactory Marginally Satisfactory Unsatisfactory

Comments: Please write any comments you may have on the back of this form, e.g. how this workshop could be improved; features of the workshop that were exemplary; kind of folow-up needed; how you will implement knowledge/skills/attitudes in the classroom; etc.

*Adapted from Maryland State Department of Education's Participant Response Form

APPENDIX Q

PARTICIPANT RESPONSE FORM COMMENTS

Comments From the Participant Response Form

- Information presented in logical easily understood manner. Group participation was high. Information very interesting and fun.

- Most was a review of psychology courses, I'm interested in the application.

- The presentation was excellent but was not as practical as I expected. The research background was superb. I would have liked more discussion in small groups.

- Can't wait for the practical side.

- All biology, lets get to how it will help out careers.

- More time should be spent on reading and interpreting our personal profiles rather than lecturing on the background in brain studies, although some of the background is necessary.

- Mr. Craney was an excellent speaker. I feel we need a general background of information to help us in the classroom, but don't feel it's necessary to know all the technical terms and to fill out the evaluation instruments.

- An awful lot of background, more "hands-on" needed.

- Mr. Craney did a fine job but why was this necessary especially taking one and one half days away from teaching.

- The workshop was geared toward educational implications. A half day would have been sufficient.

- Well organized, interesting, hope to share team profiles.

- The workshop lays the foundation of information needed for application.

- Presenter did a good job presenting information in a variety of media, however, I did not find the experience particularly stimulating or of immediate help in the classroom.

- I feel we were too involved. We would deal with applications and have a quick overview of the brain as an introduction.

- Will I really use or need to know technical scientific terms concerning the brain?

- I was expecting information that would help me with teaching children with different learning styles.